

RESEARCH ARTICLE

The Problem of Sustaining a Successful Enterprise: Kodak's Multiple Takes at Strategic Renewal that Culminated in Failure

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Abstract

In 1888, George Eastman introduced Kodak, one of the first affordable, user-friendly photographic film cameras. The camera's success planted seeds for a global market for amateur photography that the Eastman Kodak Company would dominate for over a century. Leveraging substantial profits from photographic film, Kodak invested heavily in research and development, continuously innovating in amateur photography and pioneering new technological domains. From the 1970s onward, as growth in its core business began to slow and new imaging technologies emerged, Kodak embarked on significant strategic renewal initiatives. These efforts included diversifying into industries such as plain paper copiers and pharmaceuticals and developing digital products for photography applications. Despite considerable investments in innovation and growing new businesses over several decades, Kodak ultimately failed to find a viable path to sustaining its success; it filed for bankruptcy in 2012. The company's decline illustrates the inherent challenges of sustaining a successful enterprise in evolving markets and technologies. Furthermore, it raises critical questions about the effectiveness of strategic renewal efforts, particularly when high-performance expectations are set within an environment of significant uncertainty.

Keywords: technological change; incumbent; strategic renewal; decision-making

In January 2012, after more than a century of dominating the global market for amateur photography and maintaining a long-standing commitment to innovation, the Eastman Kodak Company (Kodak) filed for bankruptcy. Throughout the twentieth century, Kodak was iconically associated with photographic memories, but today, it has become synonymous with corporate failure in the face of technological change. A commonly

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espoused explanation for the failure of an established firm in the face of technological change—including Kodak's—is rooted in inertial processes that impede the firm's ability to transform itself and respond to the changing business environment.¹

Somewhat at odds with such inertia-based explanations, however, in the decades leading up to Kodak's bankruptcy, the company pursued multiple major initiatives intended to diversify beyond its core film photography business and spearhead the development of emerging digital photography technologies. Although Kodak's initiatives met with some success, they ultimately failed to stem the company's decline. In fact, Kodak's actions align with several established recommendations for strategic renewal within the academic literature, such as investing in research and development (R&D) in new technological and market domains, regularly introducing new products, and pursuing innovation through acquisitions.² Understanding why these diversification efforts failed to avert Kodak's eventual bankruptcy can provide valuable insights into the limitations of these renewal strategies and offer a deeper understanding of the dynamics of a large firm's decline. Such insights are essential for developing a more comprehensive business history of corporate failure.³

Kodak's long-standing commitment to innovation makes the company a particularly compelling case for illuminating the process of corporate decline. The Eastman Kodak Company bears the name of its founder, George Eastman, and the firm's first successful product—the Kodak camera. Introduced in 1888 as the first affordable, user-friendly film

¹ Specifically, scholars explaining incumbent failure have documented economic, organizational, and cognitive antecedents of inertia. The economic antecedents include a disincentive to invest in a potentially cannibalizing new technology. Kenneth J. Arrow, "Economic Welfare and the Allocation of Resources for Invention," in *The Rate and Direction of Inventive Activity: Economic and Social Factors* (Princeton, NJ, 1962): 609–626; Rebecca Henderson, "Underinvestment and Incompetence as Responses to Radical Innovation: Evidence from the Photolithographic Alignment Equipment Industry," *RAND Journal of Economics* 24 (Summer 1993): 248–270; Jennifer F. Reinganum, "Uncertain Innovation and the Persistence of Monopoly," *American Economic Review* 73 (Sept. 1983): 741–748; Jennifer F. Reinganum, "The Timing of Innovation: Research, Development, and Diffusion," in *Handbook of Industrial Organization*, ed. Richard Schmalensee and Robert Willig (Amsterdam, 1989), 849–908. The organizational antecedents include resource allocation processes, invention, and commercialization routines that favor prevailing technologies and business models. Gautam Ahuja, Curba M. Lampert, and Vivek Tandon, "Moving beyond Schumpeter: Management Research on the Determinants of Technological Innovation," *Academy of Management Annals* 2 (2008): 1–98; Clark G. Gilbert, "Unbundling the Structure of Inertia: Resource versus Routine Rigidity," *Academy of Management Journal* 48 (2005): 741–763; Michael L. Tushman and Philip Anderson, "Technological Discontinuities and Organizational Environments," *Administrative Science Quarterly* 31 (Sept. 1986): 439–465. The cognitive antecedents include applying mental models rooted in the firm's competencies, identity, business model, and complementary assets to the new technology. Mary Tripsas and Giovanni Gavetti, "Capabilities, Cognition, and Inertia: Evidence from Digital Imaging," *Strategic Management Journal* 21 (Oct.–Nov. 2000): 1147–1161.

² For an overview of this literature, see Rajshree Agarwal and Constance E. Helfat, "Strategic Renewal of Organizations," *Organization Science* 20 (Mar.–Apr. 2009): 281–293 as well as Charles A. O'Reilly and Michael L. Tushman, "Organizational Ambidexterity: Past, Present, and Future," *Academy of Management Perspectives* 27 (Nov. 2013): 324–338.

³ Alfred D. Chandler's *Scale and Scope* thesis outlines investing in mass-production, international sales, and distribution organization and building up managerial ranks as conditions for shaping large firms' growth (conditions the Eastman Kodak Company clearly met). However, we know less about the dynamics of such firms' decline. Philip Scranton argues that studying these dynamics is critical for developing a richer understanding of the business history of failure. "Classic Issues and Fresh Themes in Business History," *OAH Magazine of History* (Jan. 2010): 11–15.

cameras, “Kodaks” expanded the appeal of amateur photography to the mass market. Eastman advertised the accessibility of photography embodied by his cameras in popular press with the slogan, “You press the button, we do the rest,” and distributed them through pharmacies, grocers, and convenience stores rather than specialty photography retailers. Starting in the 1890s, the firm developed a global distribution network, opening subsidiaries in the UK, Germany, France, and Australia.

From its early days, Kodak invested heavily in both the development of new products and basic research. The firm recognized film’s contribution to Kodak’s profitability and offered cameras at successively lower price points: \$25 in 1888, \$5 in 1895, and \$1 in 1900. To capitalize on the explosive demand for film, Kodak developed expertise in mass manufacturing, introducing process innovations such as continuous wheel production of film. By 1896, the company manufactured 400 miles of photographic film per month.⁴ In the 1930s, Kodak’s research laboratories produced the first commercial color film for amateur photography—a product the firm would sell for the next 80 years—with no competitor matching its quality for 50 of those 80 years.

Beyond amateur photography, Kodak also cultivated applications for photographic film and paper that would emerge as major businesses. For instance, less than a year after Wilhelm Roentgen discovered X-rays in 1895, Kodak introduced the first photographic paper for capturing X-ray images. In addition, in the 1890s, the firm collaborated with Thomas Edison on developing motion picture technology. By 1922, Kodak manufactured 147,000 miles of motion picture film per year, an endeavor that consumed one-twelfth of all silver mined in the US.⁵

Kodak went public in 1905 and joined the Dow Jones Industrial Average in 1930. From the inception of the *Fortune* 500 list in 1955 until the mid-1990s, Kodak consistently ranked among the top 50 US firms, with its market capitalization exceeding \$26 billion in 1996. In the 1980s, the company accounted for 2% of all industrial R&D performed in the US and employed over 145,000 people. Even as sales of photographic film started to decline in 2001, Kodak led the US in the number of patents generated, held top market share in digital cameras in the mid-2000s, and ranked as one of the world’s most trusted brands.⁶

Faced with the prospects of slowing growth in its core film business and the emergence of digital technology, Kodak pursued major strategic renewal initiatives. Between the 1970s and the 1990s, Kodak diversified into new markets, investing billions of dollars to grow three key businesses: plain paper copiers, pharmaceuticals,

⁴ World War I highlighted the dependence of US firms on the organic compounds produced by the German chemical industry. Concerned about the implications of potential disruptions to the global supply chain to film manufacturing, George Eastman founded Eastman Tennessee—a subsidiary for producing chemical inputs for Kodak’s film from local timber—in 1920.

⁵ Only the US Mint used more silver than Kodak. *Rochester Business Journal*, 2012.

⁶ In 1996, Interbrand ranked Kodak 4th on its list of top 10 brands in the world. Chris Roush, “McDonald’s, Coca Cola 1–2 in fame,” *Atlanta Constitution*, 14 Nov. 1996, 1F. In 2001, Interbrand ranked Kodak 27th of the top 100 most valuable brands in the world. Interbrand, “World’s Most Valuable Brands Ranked by Interbrand 2001,” accessed 18 Sept. 2024, https://www.museum.brandhome.com/docs/P0005_Brandvalue.pdf.

In 2010 and 2011, Reputation Institute ranked Kodak as one of the top 20 most reputable companies on the basis of a survey of 33,000 consumers in the US. Molly Cappotelli, “Kodak Ranks on List of Most Reputable Companies,” *Rochester Business Journal*, accessed 18 Sept. 2024, <https://rbj.net/2011/04/06/kodak-ranks-on-list-of-most-reputable-companies/>.

and digital photography. Kodak's management viewed these businesses as growth opportunities that would complement its profitable but maturing film franchise. The three businesses represented applications of Kodak's core competencies in imaging and fine chemistry, aimed at securing future growth. The copier business leveraged and expanded Kodak's imaging expertise into a new line of business. The pharmaceutical business sought to translate decades of fine chemistry research, including a library of 500,000 proprietary compounds developed in film research, into medications. Finally, Kodak invested heavily in digital imaging to create and shape the evolving technology, which would ultimately replace film in amateur photography. In 1991, the copier and pharmaceutical businesses accounted for more than two-fifths of Kodak's total sales.

Despite extensive efforts to pursue new business trajectories, including a \$5.1 billion acquisition of Sterling Drug in 1988, the firm struggled to generate meaningful financial returns from these investments. The intense competition in the copier market meant that, after decades of investment, the business was barely breaking even. While the pharmaceutical business accounted for a quarter of Kodak's earnings in 1991, the acquisition of Sterling Drug saddled the company with expensive long-term debt.⁷ Unable to sustain its investments across copiers, pharmaceuticals, and photography, Kodak divested its copier and pharmaceutical businesses between 1994 and 1996 (also spinning off a legacy chemical manufacturing subsidiary founded by George Eastman in 1920) to focus on its core photography business.

Through its early and sustained investment in digital photography, Kodak succeeded in pioneering multiple ground-breaking technologies (e.g., high-resolution sensors, color filters, and image compression algorithms) and producing award-winning products. However, the firm faced external challenges that hindered its ability to translate technological and market leadership into strong financial performance. First, products embodying digital technology had to overcome substantial adoption challenges; decades passed between the early development of technology and the emergence of a mass market for digital cameras. Second, by the time annual worldwide sales of digital cameras reached 1 million units in 1999, numerous competitors had entered the industry. This increased competition drove down prices, making it difficult for any participant to achieve sustained profitability.

Kodak's difficulties in generating meaningful financial returns illustrate a modern corporation's challenges in seeking to sustain itself through a range of strategic renewal initiatives. In Kodak's case, these efforts included investing in R&D, developing capabilities in new technologies, exploring new markets, and using acquisitions to diversify away from a maturing business. Despite adopting these strategies and employing impressive technical and managerial talent, Kodak could not avert its decline. A combination of uncertainty within the business context, competitive pressures, and significant costs contributed to multiple setbacks, ultimately culminating in the firm's bankruptcy.

In presenting our findings, we first detail the origins of the Eastman Kodak Company, emphasizing the role of innovation in its early success. We then describe the company's exploration of new growth opportunities in copier, pharmaceutical, and digital photography businesses. Finally, we reflect on the firm's decline, despite its multi-decade efforts at strategic renewal.

⁷ Brenda L. Landry, "Eastman Kodak—Company Report," Morgan Stanley & Co., Inc. (11 Aug. 1992), 8.

Origins of the Eastman Kodak Company

George Eastman was working as a bank clerk in Rochester, New York, when he became interested in photography in the late 1870s. At the time, the prevalent photographic technology used wet glass plates—rectangular panes of glass covered with light-sensitive chemical solution to capture the images. Amateur photography was a demanding endeavor, requiring chemical expertise (to mix corrosive chemicals for sensitizing glass plates and developing the resultant images), patience (to wait anywhere from 20 seconds to five minutes for a single image to be captured), and physical strength (to hoist 40–70 pounds of equipment, including the camera, tripod, glass plates, dark tent, and chemicals). A mid-range set of photographic equipment in the 1870s cost around \$50 (or about \$1,500 in 2025 dollars).⁸ The time, effort, expertise, and expense required for amateur photography limited its appeal.⁹

Eastman entered the photography business by manufacturing dry glass plates—an innovation that made photography more accessible to the public. The predecessor wet plate technology required the photographer to use a dark room (or dark tent when working outdoors) to cover the plates with a mixture of light-sensitive chemicals, insert the wet plates into the camera one at a time, capture the images, and then develop the images while the plates were still wet. In contrast, dry glass plates were precoated with light-sensitive chemicals, eliminating the need for the photographer to carry the chemicals or a dark tent for sensitizing and developing the plates in the field. Eastman's first invention (patented in 1879) was a machine designed to mass-produce dry glass plates. While the introduction of dry glass plates expanded photography's accessibility to a somewhat larger audience, Eastman continued looking for ways to "make the camera as easy a recorder, as a pencil" with respect to its portability, ease-of-use, and affordability.¹⁰

This search led Eastman to invent "American film"—rolls of sensitized paper initially and then thin plastic that would be used to capture the images instead of glass plates.¹¹ The shift from glass plates to film as a capture medium revolutionized photography, enabling the creation of motion pictures and the introduction of portable photographic cameras.

Prior to the introduction of film, cameras had to be sturdy enough to support the weight of glass plates, which made using a tripod necessary. The introduction of film (which weighed far less than glass plates) enabled the manufacture of smaller, lighter cameras and eliminated the need for a tripod. In addition, the introduction of film meant that the number of pictures amateur photographers could take was no longer limited by the number of glass plates they were willing to carry; the Kodak film cameras that Eastman introduced in 1888 came with enough film for 100 images. Moreover, developing images no longer required chemical expertise. After using up the film, consumers could simply mail their cameras back to Kodak and receive paper

⁸ George Eastman paid \$49.58 for his set of amateur photographic equipment (including the chemicals) and an additional \$5 for lessons on how to use it.

⁹ When Eastman became interested in photography, Rochester (population ~89,000 in 1880) had only two other amateur photographers—George Selden and George Monroe. Samuel Crowther, "Slow Profits Today, but Sure Profits Tomorrow," *System: A Magazine of Business* 28 (Oct. 1920): 608; Elizabeth Brayer, *George Eastman: A Biography* (Baltimore, MD, 1996), 27.

¹⁰ Crowther, "Slow Profits Today," 609.

¹¹ The film base would shift from paper to nitrocellulose in 1889, then to acetate by 1949.



Figure 1. A view of amateur photography in 1877.

Note: We thank Todd Gustavson and John Elsbree at the George Eastman Museum for pointing us to the cartoon and Marcella Barnhart and Victoria Sun at the Lippincott Library of the University of Pennsylvania for helping us track down Kessler's cartoon collection. (Source: Camillus Kessler, *At the Bottom of the Ladder* [Philadelphia, PA, 1926, 80].)

prints of their images and a camera freshly loaded with a new roll of film—a convenience Eastman advertised in the popular press with the slogan, “You press the button, we do the rest.”

The changes in size and weight of the photographic equipment transformed amateur photography. Whereas the photographer once accompanied a wagon of equipment on a photographic outing, now cameras could accompany the photographer in day-to-day activities.¹² Figure 1 offers a contemporary's view of Eastman's impact on photography. The Eastman Kodak Company invested heavily in

¹² An early legal treatise on the right to privacy (published two years after Kodak camera's introduction) expressed concern that “instantaneous photography,” enabled by the portability of film cameras, would lead to photographing without the subject's consent. Samuel D. Warren and Louis D. Brandeis, “Right to Privacy,” *Harvard Law Review* 4 (15 Dec. 1890): 195.

advertising its products as a means to capture snapshots of special occasions (such as family celebrations or vacations) and preserve these “Kodak moments” in photo albums. The company distributed its cameras through drugstores and other mass-market outlets, making its products easily accessible to a wide audience. From the 1890s onward, Kodak expanded the international distribution of its products, forming subsidiaries in the UK, Germany, France, and Australia. Table 1 offers a timeline of the company’s historical milestones.

In addition to multiple technological innovations, George Eastman also developed a novel business model in which the sales of a low-margin hardware product (i.e., cameras) built a customer base and drove the sales of a compatible high-margin consumable (i.e., film).

If the cameras were the only thing that produced a profit, it would be no object to sell double the number and make only the same net profit; but before the camera is dead, we ought to make at least as much from the film used in it as from the camera itself, probably more. I believe that every camera is good for at least twenty spools of film.¹³

Driven by this insight, Kodak developed and introduced successively cheaper cameras. While Kodak cameras were priced at \$25 in 1888, the company introduced cameras priced at \$5 in 1895 and \$1 in 1900. This camera/film business model became more popularly known as the “razor/blade” model following the introduction of Gillette razors in the early twentieth century.

From the company’s early days, George Eastman emphasized investment in innovation as critical to the company’s success:

I have come to think that the maintenance of a lead in the apparatus trade [camera sales] will depend greatly upon a rapid succession of changes and improvements . . . If we can get out improved goods every year nobody will be able to follow us and compete with us.¹⁴

Eastman hired the first research chemist in 1896, and in 1912, he founded Kodak Research Laboratories, funding the work of 20 people with an annual budget of \$53,797 (about \$1.75 million in 2025 dollars).¹⁵ Eastman expressed his expectations for the laboratories as “Your mission is the future of photography.”¹⁶

The leaders who succeeded Eastman continued the high levels of investment in innovation, directing 5–6% of Kodak’s sales into R&D. Kodak’s 1977 Annual Report characterized Kodak’s R&D investment as follows: “In many ways, this ‘research nickel’ has been the most important investment the company has made, engendering a new or improved product each third working day.”¹⁷ In addressing securities

¹³ Eastman, quoted in Carl W. Ackerman, *George Eastman* (Boston, MA, 1930), 116.

¹⁴ Eastman, quoted in Brayer, *George Eastman*, 34.

¹⁵ Eastman Kodak Company, *Annual Report* (1977), 18.

¹⁶ Eastman, quoted in Douglas Collins, *The Story of Kodak* (New York, 1990), 117.

¹⁷ Eastman Kodak Company, *Annual Report* (1977), 18.

Table 1. Eastman Kodak Company Milestones

Year	Event
1879	George Eastman filed for his first patent in photography.
1888	Eastman introduced Kodak—a \$25 film-based camera, which represented a technological shift from glass-plate to film photography, making cameras portable and shortening the per image exposure time from 30 minutes to seconds. Each Kodak came with a roll of film to capture 100 snapshots. For \$10, the company would develop and print the images and reload the camera with another roll of film.
1892	George Eastman changed the name of his company from Eastman Dry Plate and Film Company to Eastman Kodak Company to reflect the success of film cameras.
1895	Kodak introduced a \$5 pocket camera.
1896	Kodak introduced X-ray and motion picture film, establishing a dominant position in both markets, while manufacturing 400 miles of photographic film a month.
1901	Kodak introduced a \$1 Brownie camera.
1902	Kodak became a public company, listing on the New York Stock Exchange (NYSE).
1912	George Eastman established Kodak Research Laboratories, funding the work of 20 people with an annual budget of \$53,797 (about \$1.75 million in 2025 dollars).
1920	George Eastman founded Tennessee Eastman—a subsidiary tasked with producing chemical inputs for Kodak's film.
1930	Kodak joined the Dow Jones Industrial Average in July of 1930.
1930s	Kodak Research Laboratories developed Kodachrome—one of the first commercially successful color films, which remained in production until 2009.
1938	Kodak partnered with General Mills to distill vitamins using vacuum technology developed by its researchers.
1953	Kodak introduced Verifax—a tabletop coated-paper copier based on a dye transfer diffusion process the firm patented in 1947.
1950s	Kodak researchers invented the E-I Camera System for the government SAMOS satellite program. The camera developed the film in space and scanned the images in analog form for subsequent transmission to Earth using radio signal.
1972	Kodak Research Laboratories formed a group to develop electronic sensors. In 1974, the group invented an integral color image sensor.
1975	Kodak introduced Ektaprint—its first plain paper copier. Researcher Steve Sasson in Kodak's Apparatus Division completed the first portable digital camera prototype.
1981	Kodak introduced SP-2000—its first electronic camera capable of taking 2,000 images a second priced at \$110,000.
1984	Kodak reorganized into 17 business units, including Life Sciences and Consumer Electronics (renamed Electronic Photography in 1986).
1986	Kodak's Electronic Photography business unit introduced the first digital transceiver (transmitter–receiver) device, which uses advanced image compression algorithms to transmit electronic images via phone lines. Kodak's Videk subsidiary marketed the first megapixel digital camera.
1988	Kodak acquired Sterling Drug for US \$5.1 billion dollars to grow its pharmaceutical business. Kodak acquired IBM's copier business.
1992	Kodak brought to market the Photo CD.

(Continued)

Table I. (Continued)

Year	Event
1994	Kodak divested its pharmaceutical business and spun off Eastman Chemical as a standalone Fortune 500 company. Kodak partnered with Apple to design and manufacture the QuickTake 100 digital camera, which Apple marketed.
1996	Kodak sold its copier business to Danka for \$688 million.
2004	Kodak achieved leading market share in digital cameras in the US.
2012	The Eastman Kodak Company filed for bankruptcy protection.

analysts, Kodak managers argued that, “The return on that ‘nickel’ has been central to a company growth rate about twice that of the real gross national product.”¹⁸

Between 1966 and 2006, Kodak spent more than 5% of its total revenues on R&D for a total of \$28.7 billion in nominal dollars (\$80.6 billion in 2025 dollars). In 1968, Kodak employed more than 5,400 people in R&D around the world—a number that grew to approximately 7,000 by 1980. In 1970, Kodak Research Laboratories in Rochester alone (the company’s central research laboratory) employed 1,669 researchers with a range of educational backgrounds: three biologists, 548 chemists, 29 chemical engineers, 28 electrical engineers, 17 mechanical engineers, 22 mathematicians, 115 physicists, 105 general technologists, 564 technicians, and 238 auxiliaries. By 1998, the Kodak Laboratory staff in Rochester numbered approximately 6,500 people.¹⁹

The investment in research enabled Kodak to pursue a range of related technologies, including new vacuum distillation methods to enter the vitamin manufacturing business in 1938, introducing the Verifax coated-paper copier using a patented dye diffusion process in 1953, and engaging in space research with the US government following World War II.

Exploring New Paths for Growth

Plain paper copiers: 1970s–1990s

By 1958, the sales of Verifax, Kodak’s coated-paper copier, had reached \$30 million annually (about 3.6% of Kodak’s total sales).²⁰ Priced between \$99 and \$500, the copiers were small enough to fit on an office desk. However, the copies made by the machines had several shortcomings: they required elaborate manual effort, users had to handle chemical solutions that stained clothing, and in the case of competing technologies (i.e., thermal diffusion copiers marketed by 3M), the resulting copies faded over time. Despite these disadvantages, though, copiers gained popularity as

¹⁸ Leo J. Thomas, “The Research Nickel, the Bottom Line,” 3, Presentation to the Rochester Society of Security Analysts, Inc., Rochester, NY, 15 Nov. 1978, Box 23, Folder 8, Kodak Historical Collection #003, D.319. Legacy, Rare Books, Special Collections, and Preservation, River Campus Libraries, University of Rochester.

¹⁹ National Research Council of the National Academy of Sciences, *Industrial Research Laboratories of the United States* (Tempe, AZ, 1970), 169; R.R. Bowker, *Directory of American Research and Technology* (New Providence, NJ, 1998), 175.

²⁰ J. Walter Thompson Company, “Review of Verifax Advertising” (17 June 1958), 13; Eastman Kodak Company, *Annual Report* (1958), 3.

they replaced retyping as a primary method for producing multiple copies of business correspondence. The total copier market in 1957 amounted to \$185 million in sales, with “about \$60 million for machines and \$125 million for supplies.”²¹

Extrapolating from Kodak’s in-house experience of using one Verifax copier machine for every 100 employees or 10 typewriters in use, Paul A. Barbee, manager of Kodak’s Business Photo Methods Sales Division, anticipated that 1 million copier machines would eventually be installed worldwide. Bert S. Cross, head of 3M’s Graphic Products Group, predicted that this million would be installed by 1965, generating annual paper and supply sales of \$500 million.²²

These forecasts overlooked the potential impact of technological innovation on the industry’s growth trajectory. In 1959, Xerox introduced the 914—a revolutionary copier that used plain paper (instead of coated paper) and allowed users to produce copies at the touch of a button.²³ This new technology removed the need for handling chemical solutions and coated papers, enabled limitless copying, and eliminated concerns about copies fading over time. Unlike the smaller, coated-paper copiers marketed by Kodak and 3M, the 914 was the size of an office desk and cost considerably more than its predecessors. Rather than selling the copier outright for \$30,000, Xerox executives opted to lease the machines and charged customers by the copy—a decision that translated into enormous profits for the firm:

In its first year of operation, the average 914 generated enough copies, and hence revenues, to pay for all of the manufacturing, sales, administration, and overhead costs associated with the machine. At the end of the year, of course, Xerox still owned the 914 because of the decision to lease instead of sell it. So the revenues generated by the next year’s usage, typically even greater as the customer’s appetite for copies expanded, were mostly profit. And the same held true for the year following that. And the next. And the next. And the next.²⁴

After investing heavily in developing a national sales and service organization, Xerox leased more than 200,000 machines and invested its profits into developing new products. The combination of a breakthrough product, an innovative business model, and a robust national sales and service organization led to 15 years of profitable growth for Xerox. *Fortune* magazine even called the 914 copier “the single most profitable product ever manufactured in the US.”²⁵

By 1977, the US market for plain paper copies exploded to \$2.9 billion—\$2.4 billion from machine leases and another \$500 million from supplies. Including the \$1 billion market for offset printers and older copying technologies, the total copier market

²¹ Loehwing, “Photostat to Verifax,” *Barron’s* (12 May 1958), 3.

²² Loehwing, “Photostat to Verifax,” 3.

²³ The introduction of Xerox’s machines represented a change in the user experience of copying that was reminiscent of changes in amateur photography induced by the introduction of film. Xerox’s invention enabled the user to achieve the desired outcome (i.e., nonfading copies) by pressing a button without the need to handle chemical solutions.

²⁴ Douglas K. Smith and Robert C. Alexander, *Fumbling the Future: How Xerox Invented, then Ignored, the First Personal Computer* (New York, 1988), 37.

²⁵ *Fortune*, “Hardest Duplicating Job Xerox Ever Faced,” (Nov. 1966), 140.

grew to \$5 billion in the US and another \$5 billion in Europe, Asia, and the rest of the world. Dataquest, a research firm based in Menlo Park, projected that the copier market would continue growing at 20% per year.²⁶

Competing with Xerox

Xerox's enormous profits and rapid growth attracted competition. In 1970, IBM—whose leasing model had inspired Xerox executives—entered the market with its Copier 1, a machine targeting the low- to medium-speed segment of the market. The Copier 1 produced 10 copies per minute, compared with the 60 copies per minute produced by Xerox's fastest copier.²⁷

In 1975, after 12 years of development, Kodak introduced its Ektaprint plain paper copier, capable of producing 70 copies per minute. Kodak's entry deliberately targeted the high-speed, high-volume segment of the copier market: "The Kodak copier was designed for the customer with needs from 40,000 to 300,000 and more copies per month."²⁸ William Czamanske, Kodak's marketing lead for Ektaprint, characterized the high-volume copier customers as "highly cost-conscious in their choice of machines. 'There's virtually no brand loyalty—price, service and print quality are what's important.'"²⁹ Kay Whitmore, then general manager of Kodak's photographic division and later the company's CEO, explained Kodak's focus on this segment of the market: "We are in a particular segment of the copier business because that's where the profits are."³⁰ According to Kodak's CEO at the time, Walt Fallon, this strategic choice also allowed Kodak to enter a less competitive arena, as it "intentionally stayed away from the lower end of the line where we knew the competition was going to be."³¹ In particular, Kodak sought to avoid intense price competition with Japanese manufacturers, who had also entered the market. At launch, Fallon justified the choice of the segment by projecting it to grow by 15% annually through 1980.³²

According to Colby Chandler, the president (who would later become CEO) of Eastman Kodak, the company was drawn to the plain paper copier market not only by the high profits and growth potential but also by the opportunity to prove that "nobody knows more about imaging technology than Kodak does."³³ Despite entering

²⁶ Alexander Auerbach, "Office Copier Is Only First Page: Xerox Sparks Revolution in Print Method," *Los Angeles Times*, 26 June 1977, 11.

²⁷ "IBM Introduces Copier, and Xerox Files Patent Suit," *Wall Street Journal*, 22 Apr. 1970, 4. IBM's most successful machine, Copier II, introduced in 1972, produced 25 copies a minute and was estimated to have displaced some 20,000 Xerox machines on the market. "New Copy Machine Introduced by IBM," *Washington Post*, 2 Nov. 1972, D12; Bro Uttal, "Xerox Is Trying Too Hard," *Fortune*, 13 Mar. 1978, 88.

²⁸ Colby H. Chandler, "A Handle on Kodak's Future," 38, Presentation to the Chicago Financial Analysts, 36, Chicago, IL, 20 Oct. 1977, Box 22, Folder 28, Kodak Historical Collection #003, D.319. Legacy, Rare Books, Special Collections, and Preservation, River Campus Libraries, University of Rochester.

²⁹ Auerbach, "Office Copier Is Only First Page," 11.

³⁰ "Kodak Fights Back," *Business Week* (1 Feb. 1982), 53.

³¹ Ann Hughey, "Economy, Aggressive Rivals Pinch Kodak," *Wall Street Journal*, 18 Jan. 1983, 33.

³² Isadore Barmash, "Kodak Demonstrates a Copier That Uses Plain Paper," *New York Times*, 30 Apr. 1975, 64. Per Fallon addressing the annual meeting, "To understand our reasoning, consideration should be given to industry forecasts which project a growing copier market through 1980. The segment which will be served by the Kodak entry (20,000 to 75,000 copies a month) is expected to grow at a rate of 15% annually," James Grant, "Xerox vs. IBM et al.," *Barron's* (16 June 1975), 14.

³³ Chandler, "A Handle on Kodak's Future," 37.

the market more than 15 years after Xerox's launch of the landmark 914 copier, "in just a few years, Kodak's copier has become the technical standard."³⁴ *Fortune* magazine described the Ektaprint machine as one that was "thought to provide the ultimate in copy quality."³⁵ The copier featured a recirculating document feeder—a technology later licensed from Kodak by IBM, Xerox, and Canon.³⁶ The copier was also the industry's first to feature a microprocessor.³⁷ Industry observers lauded the technological advances in Kodak's first copier: "it was like having the first plane you built be a four-engine jet."³⁸

The technological advantage of Kodak's first copier enabled the company to enter an industry dominated by Xerox, which had placed 100,000 copiers in 1974.³⁹ In 1975, Xerox held 82% of the worldwide market in plain paper copying, with 42% of its sales and 52% of its earnings coming from outside the US. In June 1975, two months after Kodak entered the market, Xerox employed 13,500 salespeople—about half in the US and half overseas—and 24,000 service technicians out of a total workforce of 100,000 employees worldwide. By comparison, IBM, which entered the market in 1970, employed approximately 4,000 copier salespeople.

Faced with this competitive landscape, Kodak pursued a gradual entry strategy, focusing on complementing the technological strengths of its machines with their high service quality. In 1975, Kodak's copier unit employed 300–500 salespeople and 1,400 technicians. Kodak's CEO at the time, Walt Fallon, described the approach: "Kodak will enter this market in an orderly way. Our ability to service customers will be at least as important as sheer physical demand in determining production and marketing schedules now and as we head into 1976."⁴⁰ Following this strategy, Kodak installed 1,000 machines in the first 15 months, increasing the number of installations to 5,000 by 1979, reaching a total of 14,000 machines. By 1978, Kodak had secured more than 50% market share in the high-volume copier segment.⁴¹

However, Kodak's ability to translate its technological advantage into market share was short-lived. Sanford Garrett, a securities analyst with Sanford J. Bernstein Co., articulated Kodak's challenge:

³⁴ Howard Rudnitsky, "Why Kodak Will Buck the Recession," *Forbes* (3 Sept. 1979), 43.

³⁵ Uttal, "Xerox Is Trying Too Hard," 88, quoting William A. Relyea, a securities analyst with Paine Webber.

³⁶ Phil Ebersole, "'Original' Idea Earns Award for Kodak Engineer," *Democrat and Chronicle*, 25 Jan. 1988, 2D. Kodak received a patent for the technology in 1979: "Recirculating sheet feeder," US Patent 4169674A, filed on 8 Jan. 1976, issued on 2 Oct. 1979.

³⁷ The Ektaprint control module incorporated the Intel 8008 chip—the predecessor to the 8088 chip IBM used in its first personal computer in 1981.

³⁸ Subrata N. Chakravarty and Ruth Simon, "Has the World Passed Kodak By?," *Forbes* (5 Nov. 1984), 188. The Ektaprint 100, as demonstrated in April 1975, was not quite ready for prime time. "Observers were impressed with the copier's quality but typically surprised that it comes with neither a collator nor a document feed. Observes one critic, Daniel P. Lavery, associate director of Quantum Science Corporation: "It's like selling a limousine in 1975 without power steering or air conditioning." Grant, "Xerox vs. IBM et al.," 14.

³⁹ Grant, "Xerox vs. IBM et al.," 14.

⁴⁰ "Kodak's 'Instant' Unit Due," *Democrat and Chronicle*, 23 Oct. 1975, 8D.

⁴¹ Chakravarty and Simon, "Has the World Passed Kodak By," 188.

Kodak doesn't have the depth of marketing or service strength of either Xerox or IBM, so it has used technology as a wedge to get into the marketplace. With time, the size of the lead it has is going to diminish. I would think that Xerox and IBM wouldn't be far behind with comparable products, especially Xerox.⁴²

Despite its gradual pace of expansion, Kodak's entry into the copier business elicited a vigorous competitive response. In 1982, IBM entered the high-volume segment, nearly halving Kodak's market share. However, Xerox's reaction to Kodak's entry was even more consequential. David Kearns, who later became Xerox's CEO, described the impression Kodak's copier made on Xerox senior managers:

It was as if the atomic bomb had been dropped at Xerox. We were dumbstruck. The Kodak machine was simpler and much less costly than Moses [Xerox's copier under development], and it didn't break down much. At the time, I was on the marketing side of the company, and when I saw the Kodak machine, I realized for the first time that you could make a more reliable copier than ours. Up until then, I thought our engineers were doing as well as possible with a complex technology.⁴³

In the short term, Xerox responded to Kodak's entry by introducing the 8200 machine equipped with advanced features specifically designed to compete with Kodak's Ektaprint 150 in 1979.⁴⁴

In the long-term, Kodak's entry into the market prompted Xerox to revamp its product development process and redesign the company around principles of lean manufacturing and total quality management.⁴⁵ As a result, Kodak went from competing with an incumbent that had been somewhat complacent to competing with an aggressive, lean entity with a much larger sales and service organization and whose copier revenues matched those of Kodak in all of its businesses. The competition was decidedly uneven. In 1982, Kodak introduced the Ektaprint 250, touted as "the first copier ever from any manufacturer to offer automatic, single-pass, two-sided copying at full machine speed."⁴⁶ However, before the Ektaprint 250 could

⁴² "Eastman Kodak Co. Adds Three Features to Copier-Duplicator Introduced in 1975," *Wall Street Journal*, 1 Apr. 1976, 5. The users' willingness to make do with lower copy quality than what Kodak was selling also detracted from the efficacy of Kodak's technology as a wedge. For instance, see "Xerox Introduces 3 Copier-Duplicators, Including Direct Challenge to Kodak Item," *Wall Street Journal*, 31 Oct. 1979, 6.

⁴³ David T. Kearns and David A. Nadler, *Prophets in the Dark: How Xerox Reinvented Itself and Beat Back the Japanese* (New York, 1992), 82. Xerox executives were taken aback by Kodak's entry in part because they expected IBM (given its computer expertise) to be the first company to incorporate microprocessor technology in its copiers.

⁴⁴ "Xerox Introduces 3 Copier-Duplicators," *Wall Street Journal*, 6.

⁴⁵ Xerox's efforts were described in a book titled *Xerox: American Samurai* by Gary Jacobson and John Hillkirk (New York, 1986) and culminated in Xerox winning the Malcolm Baldrige award in 1988, thus, outscoring in the final round Kodak's Eastman Chemical subsidiary, which would not receive the award until 1993—the year it was spun off from Kodak.

⁴⁶ Walter A. Fallon, "Cornerstones of the Future," 1983 Eastman Kodak Shareholders Annual Meeting.

gain traction, Xerox introduced its Marathon series of copiers the next year, easily surpassing Kodak's 1982 offering.⁴⁷ By 1984, Kodak's market share in the high-volume copier segment shrank to less than 20%—a loss from which Kodak would not recover.⁴⁸ Xerox's transformation exacerbated the industry dynamics, making it difficult for any firm other than Xerox to achieve profitability in copiers. Success in the high-volume segment required massive upfront investments in R&D to continually develop new copiers and a large sales and service organization to secure market success and profitability.

Kodak's success at developing "third generation" features, such as the automatic feeder and stapling/finishing units in 1976, was not enough to overcome the disadvantages posed by its smaller sales and service organization. Kodak struggled to leverage technology to overcome the scale advantages of Xerox's and IBM's sales forces. As a result, Kodak fell behind the competition. Between 1978 and 1983, the high-volume segment of the market grew by 46% annually, but Kodak's sales only grew by 28%.⁴⁹ Mike Murray, Kodak vice-president in charge of copiers, explained Kodak's difficulties in keeping up: "You can't add resources fast enough."⁵⁰

Kodak's challenges in building a large sales and service organization to compete with Xerox in the copier business effectively contributed to poor financial performance. Despite investing \$100 million in product development, the copier business generated only \$10 million in revenue in 1976, with expectations of achieving \$200 million by 1979.⁵¹ Though there were expectations that the copier business would become profitable within a year or two of entry, it lost US \$30 million annually in its first five years, only breaking even in 1980.⁵² In 1981, Kodak invested an additional US \$50 million in a copier manufacturing facility.⁵³ However, again, this investment did not translate into market share gains. In 1995, in the 91+ copies per minute segment, Xerox held 75% market share, while Kodak held 12.5%. In the 70–90 copies per minute segment, Canon led with 20%, followed by Xerox with 18%, and Kodak with 17%.⁵⁴

Kodak's decision to target the high-volume segment of the copier market put it at another disadvantage to Xerox, which could spread its R&D costs over 60% of the market that Kodak chose to forgo. Accordingly, Xerox's R&D budget for copiers almost equaled Kodak's total R&D expenditures across all its businesses. In other words, Kodak's copier R&D budget was just a fraction of Xerox's. Figure 2 compares Xerox's sales and R&D expenses with those of Kodak.

⁴⁷ Chakravarty and Simon, "Has the World Passed Kodak By," 188.

⁴⁸ Uttal, "Xerox Is Trying Too Hard," 88, quoting William A. Relyea.

⁴⁹ Chakravarty and Simon, "Has the World Passed Kodak By," 188.

⁵⁰ Jacobson and Hillkirk, *Xerox: American Samurai*, 88.

⁵¹ Rudnitsky, "Why Kodak Will Buck the Recession," 43.

⁵² "Eastman Kodak Co. Adds Three Features," *Wall Street Journal*, 5; Linda Snyder Hayes, "What's Kodak Developing Now?," *Fortune*, 23 Mar. 1981, 82.

⁵³ "Kodak Sets \$50 Million Facility to Produce Copier-Duplicators," *Wall Street Journal*, 7 Jan. 1981, 39.

⁵⁴ Leslie Sopko, "Xerox Flexes in Face of New Competition," *Democrat and Chronicle*, 10 Sept. 1996, 6A.

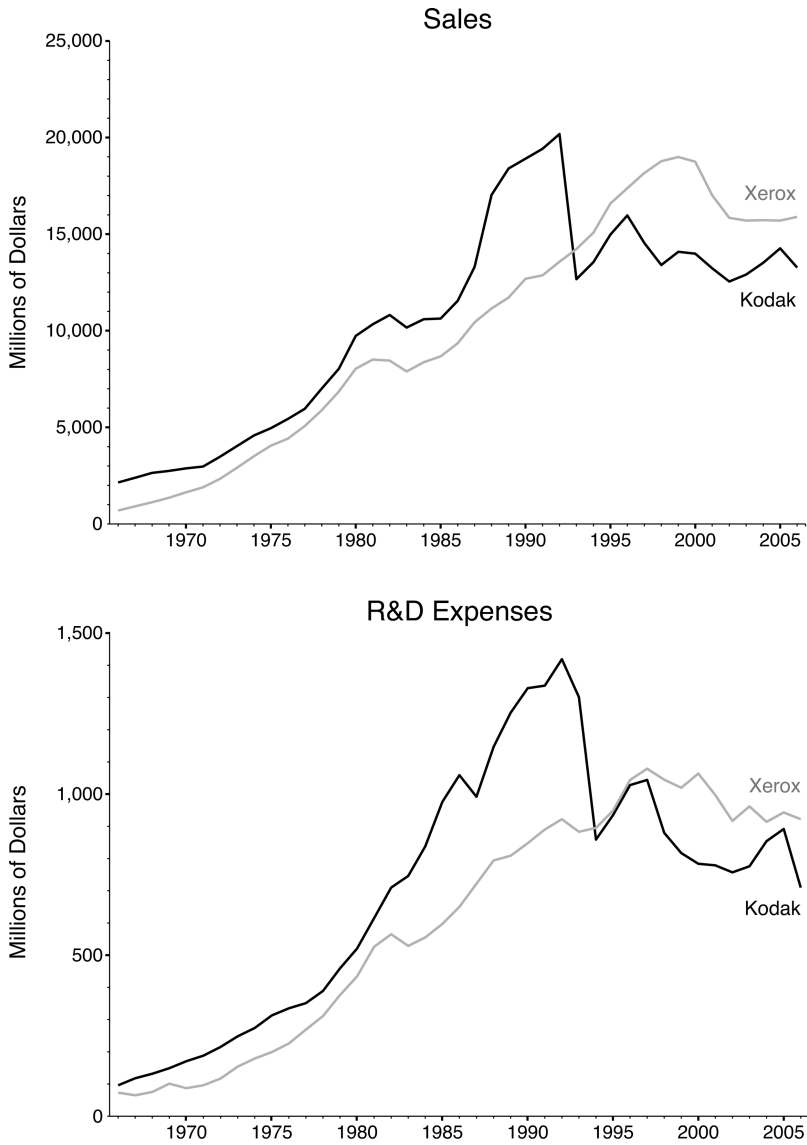


Figure 2. Xerox and Kodak sales and R&D expenditures (in US\$ millions).

Note: The jumps in Kodak sales and R&D expenses in the 1980s are attributable to its acquisition of Sterling Drug in 1988 and dissipate following the sale of the Sterling Drug businesses in 1994. (Source: Annual reports for Xerox and Eastman Kodak Company.)

As Figure 2 shows, Xerox's copier revenues were comparable to Kodak's total revenues from all its businesses—a scale advantage that made it difficult for Kodak to achieve profitability.⁵⁵

Appreciating the need for scale, Kodak entered a series of alliances, starting with Canon in 1984. In this first alliance, Canon agreed to be the original equipment manufacturer (OEM) for Kodak, with Kodak marketing Canon-made copiers under its own brand in the medium-speed segment in the US.⁵⁶ In a follow-up alliance in 1988, Kodak agreed to be the OEM for Canon's high-speed copiers, which were marketed under the Canon brand in Japan. Securities analysts saw the 1988 alliance as an attempt by both players to build scale in the industry:

The industry switch-over to digital equipment (in copiers and printers) would require a constant flow of new products, and the consequent costs would have penalized Kodak, with \$2 billion in sales, far more than Xerox, with \$12 billion in revenues. The agreement will provide both Canon and Kodak with the economies of scale in two key areas—R&D and manufacturing.⁵⁷

In another effort to build scale, in 1988, Kodak acquired IBM's copier sales and service organization.⁵⁸ The acquisition of IBM's copier business doubled Kodak's market share while eliminating an important competitor.⁵⁹

In addition to partnering with other firms, Kodak continued seeking out niches in which it could maintain its technological leadership. For instance, its color copiers, which produced 24 copies per minute, were the fastest in the industry.⁶⁰ Leveraging its work in digital photography, Kodak introduced the 1500 digital copier in 1991, featuring the fastest charge-coupled device in its scanner and offering 400-dots-per-inch resolution.⁶¹ In addition to industry-leading products, Kodak's research on copiers also benefitted its film business, leading to the introduction of Ektavolt—a film that relied on organic photoconductors rather than silver for image taking.⁶² Beyond research

⁵⁵ Kodak's difficulties in matching Xerox's scale are reminiscent of Alfred D. Chandler's description of the challenges new entrants face in overcoming the large incumbent firm's first mover advantage: "to benefit from comparable costs, challengers had to construct plants of comparable size, and to do so after the first movers had already begun to work out the bugs in the new production processes. The challengers had to create distribution and selling organisations to capture markets where first movers were already established. They had to recruit management teams to compete with those already well down the learning curve in their specialised activities of production, distribution, and (in technologically advanced industries) research and development." Chandler, "Managerial Enterprise and Competitive Capabilities," *Business History* 34, no. 1 (1992): 16.

⁵⁶ The business press interpreted this development as attesting to setbacks in Kodak's in-house R&D. See, for example, Chakravarty and Simon, "Has the World Passed Kodak By," 188. However, the 1988 Kodak alliance with Canon undercuts the validity of this interpretation.

⁵⁷ Ty Govatos, "Kodak—Company Report," Donaldson, Lufkin & Jenrette Securities Corporation (10 July 1992), 3.

⁵⁸ D. J. McNeill, "Eastman Kodak—Company Report," Drexel Burnham Lambert Inc. (7 July 1988), 13.

⁵⁹ Clare Ansberry and Paul B. Carroll, "Kodak Agrees to Purchase Most of IBM's U.S. Copier Business," *Wall Street Journal*, 20 Apr. 1988, 3.

⁶⁰ Donald Zwyer, *Eastman Kodak Company—Company Report* (Kidder, Peabody & Company, Inc., 11 Sept. 1989), 15.

⁶¹ Brenda L. Landry, "Eastman Kodak—Company Report," Morgan Stanley & Co., Inc. (23 Jan. 1991), 1–3.

⁶² Don Leavitt, "Kodak's Silverless Lining," *Popular Photography* 87 (July 1980): 74.

synergies, the copier division also provided “the critical mass available to manufacture equipment that supports microfiche and diagnostic imaging products.”⁶³

Despite these technological accomplishments and growing faster than any other business at Kodak, the copier business continued to struggle financially.⁶⁴ In 1987, copier sales accounted for 16% of Kodak’s revenues but made, at most, a negligible contribution to earnings.⁶⁵ By 1989, the copier division generated a \$360 million loss. In 1990, it posted a modest \$5 million profit on revenues of \$4.1 billion.⁶⁶ Despite Kodak CEO Whitmore’s promise that the division would generate a 10% return by 1995, the Information Systems Division (which housed the copier business) reported losses of \$151 million in 1992 and \$137 million in 1993.⁶⁷

By the 1990s, Wall Street viewed Kodak’s investment in the copier business as wasteful. First Boston securities analyst Jack Blackstock described the situation: “Kodak has spent a lot of cash flow from businesses it’s really good at [i.e., photographic film] on businesses it’s not good at. If they stopped doing that, they’d be in good shape.”⁶⁸ In 1996, Kodak sold its copier sales and service business to Danka, a copier servicing firm that sought to capitalize on Kodak’s strong sales and service organization. While selling for \$688 million, Kodak retained the manufacturing operations, and Danka committed to investing an additional \$175 million in Kodak copier R&D.⁶⁹

In summary, Kodak’s experience in the copier business represented an effort to diversify into a high-margin, high-growth business where it had technological expertise. The company sought new business with higher growth potential than its established film franchise. However, Kodak’s efforts in copiers fell short of achieving sustained profitability in part due to the external challenges of an intensely competitive environment. While Kodak initially achieved 50% market share in the high-volume market segment, its entry intensified the competition, pushing Xerox to embrace lean production and total quality management practices. This shift made the competitive environment even more challenging for Kodak.

Competing in the copier market required significant, ongoing investment in both R&D and a national sales and service organization. Moreover, maintaining such high levels of investment in copiers was challenging without a large, established customer base. Kodak attempted to build this base by developing cutting-edge technology. When technological leadership did not translate into market share, it sought partnerships with firms such as Canon and IBM. Despite these efforts, Kodak’s copier business struggled with slim margins over multiple decades, ultimately leading to its

⁶³ Matthew Diserio, “Eastman Kodak Company—Company Report,” PaineWebber, Inc. (21 May 1993), 3.

⁶⁴ Hughey, “Economy, Aggressive Rivals Pinch Kodak,” 33.

⁶⁵ Ty Govatos, “Kodak—Company Report,” Donaldson, Lufkin & Jenrette Securities Corporation (3 Sept. 1987), 1–2.

⁶⁶ Jonathan Weber, “Changing Picture at Kodak,” *Los Angeles Times*, 21 Apr. 1991, D9.

⁶⁷ Wendy Bounds, “Kodak in Talks to Provide IBM with Copiers,” *Wall Street Journal*, 3 Jan. 1995, 13.

⁶⁸ Joan E. Rigdon, “Kodak’s Changes Produce Plenty of Heat, Little Light,” *Wall Street Journal*, 8 Apr. 1992, B4.

⁶⁹ Nikhil Hutheesing, “Copier Cats,” *Forbes* (27 Dec. 1999), 89. In 1998, Danka found itself on the verge of bankruptcy and ended its agreement with Kodak to continue investing in copier R&D and buying copiers manufactured by Kodak. In 2008, Danka was bought by Konica Minolta for \$240 million.

sale. The contrast between the ongoing struggles of the copier business and the profitability of Kodak's established photographic film franchise made it increasingly difficult to justify continued investment in the copier business.

Pharmaceuticals: 1980s–1990s

Kodak's Life Sciences business unit emerged from the company's 1984 reorganization into 17 business units. In the 1985 annual report, division president Jack Thomas articulated the division's mission: "[to] develop and commercialize new products growing from our extensive capabilities in chemistry and biotechnology—a logical extension of our base businesses."⁷⁰

Securities analysts viewed the move into life sciences as an overdue and necessary step in diversifying away from the firm's core film photography business, whose growth slowed to 4% per year in the early 1980s, down from 8 to 10% annually in previous decades.⁷¹ The film business was also facing emerging threats. For instance, Eugene Glazer, analyst with Dean Witter Reynolds, argued that "faced with a strong dollar that hurt foreign sales, a disc camera that did not meet sales expectations and other threats from competitors such as the electronic still camera, Kodak 'has finally recognized the slowing growth in its basic business.'"⁷² Similarly, Stanley W. Morten, analyst with Wertheim & Co., suggested that "ancillary activities were ignored by Kodak in the past, but with a sluggish demand for photographic products, the pressure's been on to do something about it."⁷³ Securities analysts also saw the potential of a strong pharmaceutical business, which could stabilize Kodak's earnings. For instance, Robert K. Hedrick, an analyst with the Dallas investment firm Eppler, Guerin & Turner, posited that, unlike the sales of photographic cameras and film (which are negatively affected by economic downturns), "drugs are something you have to have. Drug sales aren't affected so much by the economy."⁷⁴

As with copiers, Kodak senior managers saw healthcare as a business with significant potential for both profitability and growth. Kay Whitmore, Kodak's president argued: "The life sciences and healthcare industry has traditionally enjoyed rates of profitability well above the all-industry average. Healthcare is expected to grow considerably faster than the gross national product."⁷⁵ Part of Kodak's interest in biotechnology was attributed to an Arthur D. Little forecast predicting a \$23 billion global biotechnology market by the year 2000.⁷⁶

The Life Sciences business unit entered multiple partnerships to investigate promising biotechnology innovations. These efforts included a \$2.5 million grant to support Cornell's Biotechnology Center for four years, financing clinical trials for

⁷⁰ Eastman Kodak Company, *Annual Report* (1985), 19.

⁷¹ Elaine Johnson, "Kodak Facing Big Challenges in Bid to Change," *Wall Street Journal*, 22 May 1985, 6.

⁷² Glazer also asserted that Kodak would be interested in gene engineering in the long term. John D. Campbell, "Kodak's Biotech Move Overdue, Analysts Say," *Democrat and Chronicle*, 22 Feb. 1985, 8D.

⁷³ Campbell, "Kodak's Biotech Move Overdue," 8D.

⁷⁴ Denise Gellene, "Playing 'White Knight,' Eastman Kodak Offers \$5.1 Billion for Sterling," *Los Angeles Times*, 23 Jan. 1988, CSD1.

⁷⁵ Phil Johnston, "Healthy Profits Underlie Biomedical Acquisitions," *Rochester Business Journal*, 7 Mar. 1988, 20.

⁷⁶ Campbell, "Kodak's Biotech Move Overdue," 8D.

acquired immunodeficiency syndrome (AIDS) drugs, and purchasing a license for a drug delivery system.⁷⁷ Kodak also created a \$45 million joint venture to research nucleic acids with the goal of developing antiviral and antiaging drugs, entered into a \$6 million joint R&D alliance to investigate monoclonal antibodies, and initiated a partnership to screen chemicals from its proprietary library for potential pesticide and herbicide applications.⁷⁸

In selecting potential partners, Kodak focused on companies with prescription drugs nearing clinical trials.⁷⁹ Kodak also contracted with Nova Pharmaceuticals in 1986 to screen the 500,000 chemical compounds in its proprietary library for potential pharmaceutical uses.⁸⁰ Kodak's managers were particularly interested in identifying drug applications in areas such as cancer, where the toxicity of the chemicals developed in its film research could be offset by the curative properties of the compounds.⁸¹

To focus its efforts in developing prescription drugs, Kodak founded an Eastman Pharmaceuticals unit within the Life Sciences division, hiring executives from Ciba-Geigy and Merck to lead the unit.⁸² In 1985, Kodak's managers set the ambitious goal of developing a pharmaceutical business that would generate over \$1 billion in sales by 1995.⁸³

Industry analysts had varying estimates of the size of the acquisition Kodak would require to achieve meaningful scale in pharmaceuticals. On the lower end, some analysts suggested that the acquisition must be in the "several-hundred million to billion-dollar range."⁸⁴ On the higher end of the estimates, James M. Meyer, an analyst for Janney Montgomery Scott in Philadelphia argued,

⁷⁷ Phil Ebersole, "Post-Holiday Film Debut Should Not Hurt Kodak," *Democrat and Chronicle*, 28 June 1986, 12C. In 1986, Kodak agreed to finance the clinical trial of Virazole, ICN's broad-spectrum antiviral drug for AIDS and influenza applications at a cost of \$2 million in the first year. "Kodak Co. to Provide Funding to ICN Pharmaceuticals," *PR Newswire*, 4 Mar. 1986. In 1985, Kodak agreed to spend \$6.66 million to acquire 10% of the stock of Elan Corp—a 120-person Ireland-based firm founded in 1969—and bought a license of its drug delivery system. Phil Ebersole, "Purchase Means Kodak's Widening," *Democrat and Chronicle*, 26 Oct. 1985, 14D, 11D.

⁷⁸ In 1985, "Kodak and ICN announced the creation of the Nucleic Acid Research Institute, a joint research venture in which the two companies would invest a total of \$45 million over a period of six years for the development of new drugs for antiviral diseases, cancer and antiaging." "Kodak Co. to Provide Funding to ICN Pharmaceuticals," *PR Newswire*. In 1986, Kodak agreed to spend \$6 million in R&D over three years and paid \$15 million for 16% equity of Cytogen—a 60-employee Princeton, NJ, firm founded in 1980—specializing in monoclonal antibodies. "Kodak Forms Alliance with Jersey Firm," *Journal News*, 16 May 1986, C7, C9. In 1987, Kodak entered into an agreement with Imperial Chemical Industries (ICI), the world's third largest agrochemical company to investigate the pesticide and herbicide applications of its chemicals. "Kodak and ICI Licensing," *British Journal of Photography* (4 Sept. 1987), 1007.

⁷⁹ Clare Ansberry, "Dreams Come True for Kodak's Thomas," *Wall Street Journal*, 26 Jan. 1988, 44. While *Wall Street Journal* reported the goal of Kodak's pharmaceutical business being in the top 10 by the late 1990s, Kodak's 1988 annual report articulated the goal for the pharmaceutical business being in the top 20 by 2000. Eastman Kodak Company, *Annual Report* (1988), 20.

⁸⁰ Phil Ebersole, "Kodak Adds Drug-Making Business," *Democrat and Chronicle*, 7 Feb. 1986, 1A–2A.

⁸¹ Barnaby J. Feder, "Kodak's Diversification Plan Moves into a Higher Gear," *New York Times*, 25 Jan. 1988, D1.

⁸² Leslie Helm and Susan Benway, "Has Kodak Set Itself Up for a Fall?," *Business Week*, 22 Feb. 1988, 136.

⁸³ The Eastman Kodak Company, *Annual Report* (1985), 19.

⁸⁴ Brad Rothenberg, "Kodak's Streamlining Plans," (Nov. 1985), 14.

Kodak could easily afford to spend “a billion or two” on an acquisition or go after a bigger deal and finance it by selling off something else. “They did look at Searle, but its main product, aspartame, isn’t a prescription drug. What could be a good match? Something the size of Sterling—Rorer is a bit small—or Syntex. SmithKline might be a little big but is at the upper-end size of a possible acquisition.”⁸⁵

Sterling acquisition

On January 4, 1988, F. Hoffman La-Roche, a major Swiss drug company, launched a hostile takeover bid for Sterling Drug, offering \$72 per share—a 27% premium over the price of the stock.⁸⁶ When Sterling’s management rebuffed the offer, Hoffman La-Roche raised its bid to \$76 per share on January 15 and later to \$81 per share on January 22. Kodak, recognizing Sterling as a good match for its pharmaceutical expansion, entered the bidding as a white knight. On January 22, Kodak offered \$89.50 per share, totaling \$5.1 billion, which was \$500 million higher than Hoffman La-Roche’s bid. This led the latter to withdraw from bidding.

Kodak CEO Colby Chandler articulated the company’s rationale for the acquisition of Sterling as follows:

The merger will accelerate our entry into the \$110 billion-plus pharmaceutical business. It also immediately provides the worldwide drug registration and marketing infrastructure that we have sought to bring Kodak’s discovery efforts closer to the marketplace.⁸⁷

At the time of the acquisition, Kodak had 12 investigative new drug applications pending with the US Food and Drug Administration.⁸⁸ Kodak’s managers believed the acquisition would expedite the regulatory approval process, thus allowing Sterling to contribute to the company’s bottom line within five years.⁸⁹ For Kodak, the Sterling acquisition was the culmination of a 3-year search for potential targets, which made the Board of Directors “comfortable” with Kodak taking on billions of dollars in debt to finance the deal and fend off competing bids.⁹⁰

⁸⁵ Robin Palley, “Kodak as a Drug Co.: More Logical Than It Sounds,” *Philadelphia Daily News*, 18 Nov. 1986, 34. In 1989, Beecham acquired SmithKline for \$7.9 billion—40% more than what Kodak paid for Sterling. In 1990, Rhone-Poulenc acquired Rorer—the smaller company on the analysts’ list of potential acquisition targets for Kodak—for \$3.2 billion.

⁸⁶ Susan Benway, Laura Pilarski and Gail Shares, “Why Is Sterling Spurning Hoffman La-Roche?,” *Business Week*, 18 Jan. 1988, 24.

⁸⁷ “Kodak to Merge with Sterling Drugs,” *British Journal of Photography* (4 Feb. 1988), 5.

⁸⁸ Ellen Goldbaum, “Kodak Finds a Good Fit with Sterling,” *Chemical Week*, 3 Feb. 1988, 9. An overview in *Democrat and Chronicle* offered a list of the potential drug candidates for testing that Kodak assembled prior to the Sterling acquisition: “These include five heart drugs with Enzon Inc. of South Plainfield, N.J., six cancer diagnosis and three cancer treatment drugs with NeoRx Corporation of Seattle, six cancer diagnosis drugs with Cytogen Corporation of Princeton, N.J., and a drug to reactivate the body’s immune system through its Immunology Ventures joint venture in Seattle.” Phil Ebersole, “Kodak Busy Planning for Future,” *Democrat and Chronicle*, 6 Mar. 1988, 10F.

⁸⁹ Clare Ansberry, “Kodak Agrees to Acquire Sterling Drug,” *Wall Street Journal*, 25 Jan. 1988, 3, 12.

⁹⁰ Kodak managers’ key concern in consummating the Sterling Drug acquisition was moving quickly to avoid the possibility of Kodak being outbid by another firm. According to Paul Smith, Kodak’s CFO who

The Sterling acquisition shifted Kodak's goal from exceeding \$1 billion in pharmaceutical sales by 1995 to becoming a top 20 pharmaceutical company by 2000.⁹¹ Sterling's CEO, John M. Pietruski, argued that Kodak viewed the acquisition as a strategic fit (i.e., gaining new capabilities) rather than a synergistic fit (i.e., realizing cost savings from eliminating redundant operations).⁹² While acknowledging the hefty premium paid, Kodak executives argued that the cost of the Sterling deal was lower than building the same capabilities internally. Kodak's CEO, Colby Chandler, saw the premium as the price for sustained profitability: "Health care is the highest-margin business of the future with a high cost of entry."⁹³

Kodak's acquisition of Sterling elicited strong negative reactions on Wall Street due to its size. Many saw the 62% premium over Sterling's trading price of \$55.125 per share as excessive, and analysts were concerned about the overleveraging of Kodak's balance sheet and the increased cost of capital. At \$5.1 billion, the Sterling acquisition far exceeded Kodak's previous largest acquisition of \$175 million for Verbatim in 1985.⁹⁴ Michael W. Ellmann, a Wertheim Schroder & Co. securities analyst, issued a research report prior to the acquisition, arguing that "we believe a deal price to be limited to a \$2 billion maximum."⁹⁵ Four years before acquisition, Ty Govatos, a securities analyst with Donaldson Lufkin Jenrette, described Wall Street's concerns about the negative impact of a potential large acquisition:

First, large acquisitions rarely work and, therefore, are not generally viewed favorably by the Street. Second, when combined with Kodak's move into other areas, many would consider such an acquisition as confirmation that the company's existing businesses are no longer attractive.⁹⁶

Indeed, some analysts voiced concerns about the opportunity cost of the Sterling acquisition. Specifically, Kodak's interest in growing its pharmaceutical business through acquisition led it to pass up other potential deals, such as acquiring Duracell to shore up its homegrown battery business.⁹⁷ Critics described Kodak's decision as "Instead of spending 10 times earnings to buy a premium battery company . . . paying 23 times earnings to buy a lackluster drug company."⁹⁸

led the search for prospective acquisitions, "If we hadn't done a lot of preliminary work, and knew that the board was comfortable with this level of debt, we could never have moved so fast." Leah Nathans, "Kodak Is Pleased with Its Purchase," *Business Month* (June 1988), 81.

⁹¹ Ansberry, "Dreams Come True for Kodak's Thomas," 44.

⁹² "Antidote for a Hostile Offer," *Journal of Business Strategy* (Sept./Oct. 1989), 6.

⁹³ Claudia H. Deutsch, "Kodak Pays the Price for Change," *New York Times*, 6 Mar. 1988, F1.

⁹⁴ Ebersole, "Kodak Busy Planning for Future," 1F, 10F. Kodak's biggest acquisition before Verbatim was its acquisition of Atex—a printing systems maker—for \$77 million in 1981.

⁹⁵ Phil Ebersole, "Kodak Swallows a Big Pill," *Democrat and Chronicle*, 31 Jan. 1988, F1.

⁹⁶ Ty Govatos, "Kodak Reorganization—Company Report," Donaldson, Lufkin & Jenrette Securities Corporation (27 Nov. 1984), 1.

⁹⁷ Timothy Dougherty, "Analysts Speculate on Kodak, Duracell," *Democrat and Chronicle*, 5 Dec. 1987, 12D.

⁹⁸ Helm and Benway, "Has Kodak Set Itself up for a Fall," 136.

The analysts argued that Kodak overpaid for Sterling, pointing to the acquired company's product mix and competencies with respect to prescription medications. From a product mix perspective, nearly two-thirds of Sterling's sales came from over-the-counter (OTC) drugs, with only 40% from prescription drugs. Moreover, profit margins from OTC drugs (15–25%) were lower than those of prescription drugs (30–35%).⁹⁹ Concerns were also raised about the weakness of Sterling's R&D organization. However, some analysts viewed this as a feature rather than a flaw in Kodak's planning. According to Alex Henderson, a securities analyst with Prudential Bache Securities, "Kodak didn't want a R&D company. It wanted a distribution channel for its own products."¹⁰⁰ Kodak planned to strengthen Sterling's R&D through its own R&D management expertise and hiring external pharmaceutical executives. In drawing attention to the discrepancy between the price Kodak paid and Sterling's capabilities, Henderson likened the Sterling acquisition to "buying a dog to pin the tail on."¹⁰¹

Further heightening concerns in the capital markets was Kodak's decision to finance the acquisition with debt instead of sales of assets. This decision changed the firm's capital structure from being 35% debt-financed to more than 50% debt-financed, prompting downgrades of Kodak's debt—S&P lowered it from AA to A-, and Moody's lowered it from double A-2 to single A-2. S&P described it as "the largest industrial downgrade" of the first quarter of 1988.¹⁰² Concerns about overleveraging the firm were amplified by a pending \$5.7 billion patent infringement lawsuit from Polaroid, which Kodak lost in September 1985, though the final payout number was still uncertain.¹⁰³ Together, these factors led to a 20% drop in Kodak's stock price in the months following the acquisition.¹⁰⁴

While Kodak's acquisition of Sterling came as an unwelcome surprise to some analysts, others pointed to the ideal fit between the two firms. For instance, Salomon Brothers' Mary Meeker, who would go on to become an influential technology analyst, argued "there aren't a lot of [drug] companies out there that would be as good a fit as Sterling."¹⁰⁵ Similarly, Peter Enderlin of Smith Barney, Harris, and Upham, made the case for the combined businesses' potential for success:

⁹⁹ "Beware Big Boats," *The Economist*, 9 Jan. 1988, 63; Ansberry, "Kodak Agrees to Acquire Sterling Drug," 3, 12. Ironically, Hoffman La-Roche was primarily interested in Sterling's over-the-counter drug rather than prescription drug business. Benway, Pilarski, and Shares, "Why Is Sterling Spurning Hoffman La-Roche," 24.

¹⁰⁰ Ansberry, "Kodak Agrees to Acquire Sterling Drug," 3.

¹⁰¹ Deutsch, "Kodak Pays the Price for Change," F1.

¹⁰² The percentage of debt in Kodak's capital structure had risen from 4 to 35% in the decade preceding the acquisition. Phil Ebersole, "Kodak Officials Make Their Case on Wall Street," *Democrat and Chronicle*, 26 Feb. 1988, 1A, 4A; "Bondholders Unite," *Barron's*, 4 July 1988, 9; "Kodak Debt Rating Lowered by Moody's," *Wall Street Journal*, 23 Feb. 1988, 55. S&P issued its downgrade on \$3.6 billion of Kodak's debt and Moody's on \$2.47 billion. Both S&P and Moody's also downgraded Sterling Drug's \$333 million debt from AAA to A- and from double A-1 to single A-2, respectively.

¹⁰³ Alex Beam, "Polaroid Seeks \$5.7 Billion from Kodak in Patent Suit," *Boston Globe*, 20 Feb. 1988, 1.

¹⁰⁴ Helm and Benway, "Has Kodak Set Itself up for a Fall," 134–138.

¹⁰⁵ Goldbaum, "Kodak Finds a Good Fit with Sterling," 9.

As far as the Sterling acquisition goes, I think there's a good chance it will turn out to be a resounding success, but it's going to take a long time, maybe 10 years. The basic thesis of combining Sterling's downstream capabilities of clinical trials and FDA approvals with greater R&D resources and Kodak's expertise in organic chemistry is still valid. *It's a business which is very compatible with Kodak's other businesses and its corporate position as a producer of high-technology, chemically-based products.* They have a lot of familiarity with the health care market already and the distribution channels. Assuming they can generate a reasonable flow of significant new drugs—which is very difficult to have any visibility on at this point, but I think that's a fairly good bet on a long-term basis—Sterling will turn out ultimately to be an excellent avenue of diversification for the company. But it's going to take longer than the market is willing to give the company at this point.¹⁰⁶

In integrating Sterling, Kodak established it as a standalone business division, on par with its photography, chemical, and photocopier businesses. The new Sterling division, with 20,750 employees, subsumed the Eastman Pharmaceuticals business unit, which had 250 employees by 1988. Kodak also appointed executives with pharmaceutical backgrounds to run the Sterling R&D organization.¹⁰⁷ Figure 3 shows the Kodak organizational chart.¹⁰⁸

In 1991, Kodak changed the name of Sterling Drug to Sterling Winthrop to reflect the greater prominence of Sterling's Winthrop unit, which focused on prescription drugs.

Despite the large investment, Kodak's pharmaceutical business faced setbacks. Sterling's promising drugs for congestive heart failure struggled to show efficacy in clinical trials, and Schering-Plough beat Sterling in introducing anticancer treatments based on interleukin-4, an anticancer drug from Kodak's joint venture with Immunex before the Sterling acquisition.¹⁰⁹ While Kodak and Sterling scientists identified some promising new technologies (such as the use of nanoparticles in drug delivery), the setbacks in clinical trials made it difficult for Kodak to show positive financial results from its acquisition.

Moreover, Kodak's acquisition of Sterling was followed by a wave of large mergers and acquisitions within the pharmaceutical industry. In April 1989, Beecham acquired SmithKline Beckman for \$7.9 billion, and in July of the same year, Bristol-Myers merged with Squibb in a \$12 billion stock swap. This merger wave significantly increased the scale of R&D in the industry, dwarfing Kodak's efforts to double Sterling's \$100 million per year R&D budget. To address these changes, Sterling entered an R&D alliance with the French pharmaceutical company Elf Sanofi in 1991. This partnership put the alliance's total sales among

¹⁰⁶ Enderlin, quoted in *The Wall Street Transcript*, "Photography & Electronic Imaging—Industry Report: A TWST Roundtable Discussion," 6 Nov. 1989 (emphasis added).

¹⁰⁷ Daniel F. Cuff, "Kodak Merger Shifts Sterling Management," *New York Times*, 24 May 1988, D3.

¹⁰⁸ In 1989, Kodak reorganized its business units into four divisions: imaging, chemicals, health, and information. Eastman Kodak Company, *Annual Report* (1989).

¹⁰⁹ Keith H. Hammonds, "Kodak May Wish It Never Went to the Drugstore," *Business Week*, 4 Dec. 1989, 72–76.

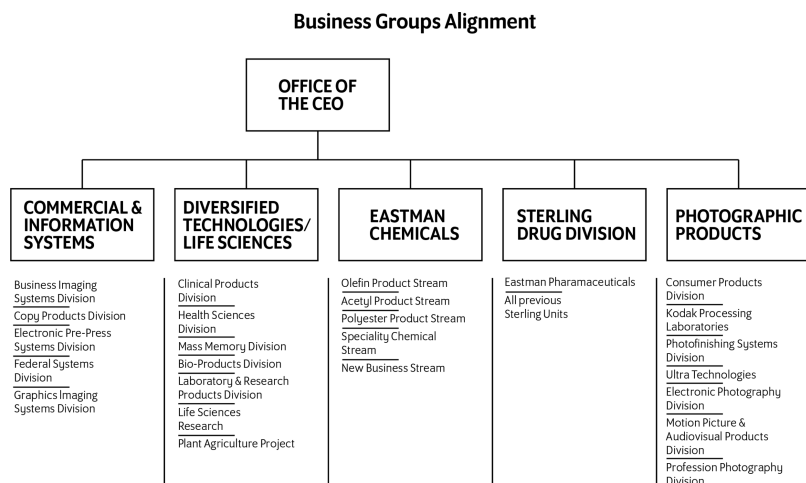


Figure 3. Sterling in the Kodak organization.

Note: We are grateful to Brad Paxton and Steve Sasson for supplying us with Kodakery archives. (Source: Tom McCormack, "Where Sterling Fits in the Kodak Family," *Kodakery*, 2 June 1988, 6.)

the top 20 pharmaceutical companies worldwide with some 30 compounds slated for co-development.¹¹⁰

In 1991, Kodak's health division, which included Sterling, accounted for 25% of the firm's revenue and 26% of its earnings.¹¹¹ The health division's performance contrasted favorably with that of the copier business, which accounted for 20% of the revenue but contributed almost no earnings. The turnaround of the pharmaceutical business even impressed some of the acquisition's earlier critics. In 1993, Prudential's Henderson admitted that Kodak had "finally got the [prescription drug] pipeline almost to the point where it may produce something" and that the pharmaceutical business is "doing a lot better than it has since they bought it."¹¹² However, the cost of servicing the debt incurred from the Sterling acquisition made it difficult for Kodak to sustain investments in the prescription drug business.¹¹³ According to Kodak CEO George Fisher, by the time he joined the company in 1993, the investments required by Kodak's different businesses forced its managers to make difficult choices about the company's direction:

The company had three great businesses: the chemical business, the photography business, and the pharmaceutical business that they acquired a few years earlier. Unfortunately, even though all of those businesses were great businesses, they all had to be fed, especially capital. And the company was generating cash of significance in only one business—the film business—and that was not enough to feed all three.¹¹⁴

¹¹⁰ "Kodak & Sterling Winthrop Describe Successes since Acquisition," *PR Newswire*, 17 Dec. 1992.

¹¹¹ Landry, "Eastman Kodak," 11 Aug. 1992, 8.

¹¹² Nancy Hass, "Flash Dance," *Financial World*, 16 Feb. 1993, 22.

¹¹³ In 1993, Kodak's debt stood at \$9.5 billion. Michael Cosgrove, "Tough Challenges Remain for Kodak," *Rochester Business Journal* (18 June 1993), 1.

¹¹⁴ Giovanni Gavetti, *Kodak: Interview with Dr. George Fisher* (DVD), Harvard Business School Video Supplement 706–802, (2005).

Faced with this challenge, Kodak senior managers chose to refocus the company on its core photography business and capitalize on the opportunities presented by digital technology. As part of this strategy, Kodak sold off its chemical and pharmaceutical businesses.¹¹⁵ In 1994, Kodak divested the businesses acquired through the Sterling acquisition, selling the prescription pharmaceutical business to Elf Sanofi for \$1.675 billion, the OTC drug business to SmithKline Beecham for \$2.93 billion, and the home products and personal care business to Reckitt & Colman for \$1.55 billion.¹¹⁶

Kodak's efforts to develop a pharmaceutical business aligned with the strategies of other chemical companies seeking to diversify. For instance, Bayer in Germany had subsidiaries that participated in chemicals, pharmaceuticals, and photographic cameras and film (Agfa-Gevaert).¹¹⁷ Similarly, Fujifilm, Kodak's smaller competitor in the photographic film business, pursued diversification into both pharmaceuticals and cosmetics. Kodak's interest in pharmaceuticals was motivated by the desire to leverage its expertise in fine chemicals in an adjacent industry characterized by high profit margins, strong growth potential, and high barriers to entry.

While Kodak was successful in advancing some of the drugs it identified through clinical trials, the competition from other pharmaceutical companies made it difficult for the company to generate substantial earnings. It is possible that, given more time, Sterling could have developed blockbuster drugs in alliance with Sanofi; however, the cost of servicing the debt from the Sterling acquisition made it difficult for Kodak to continue investing in the pharmaceutical business. Moreover, the consolidation wave in the pharmaceutical industry pushed Kodak's original goal of becoming a top 20 pharmaceutical company by the year 2000 further out of reach.¹¹⁸

Digital Photography: 1970s–2000s

Following World War II, Kodak worked on various federal government projects, supplying photographic equipment to surveillance satellites and space missions. As part of its work with surveillance satellites in the 1950s, Kodak developed technology for filmless and wireless image transfers. Rather than sending film to Earth to be processed, the E-1 Camera System (invented for the SAMOS satellite program in 1956) developed the film in space and scanned the images for transmission to Earth using radio signals. Kodak's work with the space programs provided early exposure to the evolving field of electronics, including the "manufacture of miniaturized electronic circuits that can withstand shock 20,000 times the force of gravity" and "the design of systems that combine the capabilities of photography, optics, mechanics, and electronics."¹¹⁹ Kodak also gained experience in the development and manufacture of

¹¹⁵ In 1993, Kodak spun off Eastman Chemical as a standalone company with \$2 billion in debt (to help pay down Kodak's debt) and \$1.1 billion in equity. Cosgrove, "Tough Challenges Remain for Kodak," 1.

¹¹⁶ Katie Rodgers, "Giant Mergers among Drug Firms March On," *Drug Topics*, 19 Sept. 1994, 19; *The Economist*, "Household Products: Flush with Brands," 1 Oct. 1994, 84.

¹¹⁷ Ebersole, "Kodak Swallows a Big Pill," F1.

¹¹⁸ In 2020, eight years after Kodak's bankruptcy, the company resumed its interest in pharmaceuticals, founding Kodak Pharmaceuticals division to produce ingredients for generic drugs.

¹¹⁹ Eastman Kodak Company, *Annual Report* (1967), 14.

integrated circuits, which would later be incorporated into multiple Kodak products, including cameras and copiers.

As part of its new solid-state physics research program, aimed at exploring the applications of electronic technology to photography, Kodak tasked a group of 22 researchers in 1972 with developing sensors for electronic image capture. The group produced its first working device in 1979.¹²⁰ In 1981, Kodak incorporated the sensor into the SP-2000, an electronic movie camera capable of capturing more than 2,000 images per second. Priced at \$110,000, the SP-2000 targeted industrial customers needing to perform “motion analysis of fast-moving mechanical components and manufacturing processes.”¹²¹

In parallel with Kodak’s efforts to develop sensors, an electrical engineer in its Apparatus Division research laboratory, Steve Sasson, completed the prototype of the first portable digital camera in 1975. This camera was based on the charge-coupled device (CCD) technology developed by Bell Labs in 1969. After multiple presentations to senior management, Sasson and his manager, Gareth Lloyd, filed for and received a patent.¹²² However, Kodak did not commercialize the technology at the time, citing concerns about the lack of customer interest in seeing photos on a TV screen, the relatively low resolution of the images, and the high cost of the cameras.¹²³

On August 24, 1981, in Tokyo, Sony became the first company to publicly demonstrate a prototype of an electronic still camera.¹²⁴ Industry observers saw this demonstration as heralding the arrival of a digital age in amateur photography.¹²⁵ This move by a major Japanese electronics firm forced Kodak’s senior managers to seriously consider the prospect of a digital future. At 279,300 pixels, Sony’s MAVICA (Magnetic Video CAmera) prototype’s resolution was slightly worse than that of a conventional television set (240–360 horizontal lines compared with 525-line resolution of a commercial TV program in the US) and vastly lower than the resolution of photographic film, which was comparable to 10 million pixels for a frame of 35 mm film.¹²⁶ The camera stored images on a 2-inch floppy disk, capable of recording a maximum of 50 images. Viewing the images required a viewer device that displayed the images on a TV set or computer monitor. Sony was also in the process of developing a printer for electronic images and a device for

¹²⁰ Phil Ebersole, “For Kodak Scientist, Religion Shapes Laboratory’s Miracles,” *Journal News* (21 July 1987), E3.

¹²¹ Barney J. Feder, “Kodak’s Quest for a New Camera,” *New York Times*, 6 Dec. 1981, F4.

¹²² Gareth A. Lloyd and Steven J. Sasson, “Electronic Still Camera,” US Patent US4131919A filed 20 May 1977, issued 26 Dec. 1978.

¹²³ John Robertson, General Manager, Consumer/Professional and Finishing Markets summarized Kodak’s view of electronic photography as follows: “For any number of reasons—including costs, convenience, quality, and size among others—electronic systems don’t meet the needs and expectations of the amateur still-picture taker.” Quoted in Leendert Drukker, “How Will Sony’s Video Camera Affect Photography?,” *Popular Photography* 88 (Nov. 1981), 204.

¹²⁴ “Video Still from Sony,” *British Journal of Photography* (4 Sept. 1981), 900.

¹²⁵ For example, see John Free, “Amazing New World of Electronic Photography,” *Popular Science* 219, no. 6 (Dec. 1981), 87–89, 124; Geoffrey Crawley, “The Sold State Still Camera and the Future,” *British Journal of Photography* (30 Oct. 1981): 1112–1115, 1122–1124.

¹²⁶ Steve Lohr, “Filmless Video Camera Is Introduced by Sony,” *New York Times*, 25 Aug. 1981, D1–D5.

transmitting images through phone lines.¹²⁷ In 1981, Sony estimated the price of the camera to be about \$660 (\$2,320 in 2025 dollars).¹²⁸

The low image quality and high price of the cameras—concerns raised by Kodak's management when evaluating the prospects of digital technology in amateur photography—coupled with efforts to establish the Still Video Floppy Disc as the industry standard for recording electronic images, led to a 6-year delay in Sony's ability to introduce and market the camera.¹²⁹ During this period, the focal market for the camera shifted from consumers to newspapers, as the technology offered journalists the ability to transmit images via telephone lines, bypassing the traditional process of developing the film, printing, and delivering the results.

Despite doubts about consumer adoption of electronic photography, Sony's 1981 demonstration spurred film camera manufacturers into action. In July 1986, Canon marketed the RC701 as the first electronic still video camera. Priced at \$2,595—four times higher than Sony's initial estimate—the camera offered a resolution of 380,000 pixels.¹³⁰ Along with the camera, Canon launched several devices for working with electronic images, including a viewer for displaying images on a computer monitor or TV (\$2,695), a color printer (\$6,500), and a transceiver (transmitter-receiver) for transmitting the images via telephone lines (\$19,900).¹³¹ A review in *Popular Photography*, a prominent trade journal, described the quality of electronic images reproduced by Canon's printer as “roughly equivalent to photographs reproduced on low-quality newsprint—one of the media for which this system is intended.”¹³²

In 1987, Kodak's Electronic Photography business unit introduced its still video system—a set of devices designed to handle images generated by electronic cameras. At the time, it represented the broadest line of still video components offered by any manufacturer, including two electronic image player/recorders, a TV-video transfer stand that converted prints and slides to the electronic format, and a transceiver that transmitted electronic images over telephone lines.¹³³ While Kodak's pricing was competitive with that of Canon and Sony, its transceiver deployed a sophisticated image compression algorithm, similar to the one that would later undergird the JPEG standard for digital images.¹³⁴ Notably, in 1989, Kodak's transceiver enabled the

¹²⁷ Peter Popham, “Sony's Video Snap-Shooter,” *Design* (Nov. 1981), 19; Nobutoshi Kihara, Tadahiko Nakamura, Hidehiko Okada, and Yoshimaru Maruno, “A System for Transmitting Electronic Photographs,” *IEEE Transactions on Consumer Electronics* CE-28, no. 3 (Aug. 1982): 332–336.

¹²⁸ A separate viewer device was projected to cost an additional 220, and each disk \$2.60. Leendert Drukker, “Sony's Revolutionary Video Still Camera,” *Popular Photography* 88, no. 11 (Oct. 1981): 234.

¹²⁹ For discussions of Sony's challenges, see Andrew Goldsmith, “Canon's All-Electronic Camera Shoots the Olympics,” *Popular Photography* 91, no. 10 (Oct. 1984): 48–49 and Andrew Pollack, “Sony's Troubled New Camera,” *New York Times*, 31 July 1984, D1.

¹³⁰ At the time of its US launch in 1987, the Mavica camera cost \$4,000 (\$11,260 in 2025 dollars) and had a resolution of 380,000 pixels.

¹³¹ John Durniak, “Tape Tells the Story in Canon's New System,” *New York Times*, 20 July 1986, 43.

¹³² Sean Callahan and Norman Goldberg, “The Future Arrives,” *Popular Photography* (July 1986), 63–64.

¹³³ Kodak's still video system did not include a camera, which was developed but never marketed. Terry Atkinson, “Still Video—After All These Years,” *Los Angeles Times*, 17 July 1987, E23.

¹³⁴ Majid Rabbani and Scott Daly explain the relationship between the Kodak and JPEG compression algorithms as: “Although independently developed, in many respects it is similar to the algorithm proposed by the CCITT/ISO standardization committee as the world standard compression algorithm for image transmission.” Rabbani and Daly “An optimized image data compression technique utilized in the

transmission of images from Tiananmen Square to CBS News in New York, circumventing a video satellite blockade imposed by the Chinese government. In recognition of this technological achievement, Sony and Kodak jointly received an Emmy award for “Still Picture Transmission Technology for News” in 1990.¹³⁵

While Sony and other Japanese manufacturers approached electronic photography as an expansion of their existing video camera business, Kodak viewed electronic photography through the lens of high-resolution photography—its long-standing value proposition to its customers.¹³⁶ Consequently, Kodak not only matched its competitors’ efforts in low-resolution digital photography but also sought to direct the industry’s technology trajectory toward high-resolution photography. To shape this direction, Kodak developed and commercialized high-resolution digital cameras for both new industrial applications and professional use, as well as creating high-resolution hybrid products—such as the Photo Compact Disc (Photo CD)—that combined film and digital technologies for consumers.¹³⁷

In 1986, Kodak built the first megapixel CCD imager, with a resolution of over 1.4 million pixels.¹³⁸ Within a year, the device was incorporated into both a stationary megapixel camera for scientific and industrial applications and the world’s first portable megapixel digital camera. The stationary camera was produced by Kodak’s Videk subsidiary, which was incubated as a start-up within Kodak’s Eastman

Kodak SV9600 still video transceiver,” *Proceedings of SPIE 1071, Optical Sensors and Electronic Photography* (23 May 1989), 247.

¹³⁵ Both companies received the award for their respective transmission equipment working with different news networks: Sony with CNN, *United Press International*, “Sony Gets Emmy for Technology in Tiananmen Square Coverage,” 9 Oct. 1990, accessed 17 Jan. 2025, <https://www.upi.com/Archives/1990/10/09/Sony-gets-Emmy-for-technology-in-Tiananmen-Square-coverage/8104655444800/>; Kodak with CBS Broadcasting, “Kodak,” 15 Oct. 1990, 7; Eastman Kodak Company, *Annual Report* (1990), 21; *Hollywood Reporter*, “TV Techs Get Share of Emmy Glory,” 11 Oct. 1990, 4.

¹³⁶ Specifically, Kodak managers saw the image quality of its 35 mm photographic film as the standard by which they measured technological progress in digital photography. For instance, Kodak’s CEO Walter Fallon described the capacity of electronic sensors in 1982: “And a 35 mm frame of [Kodacolor] film offers the equivalent of 40 times the capacity of today’s sensors.” Fallon, “Photography’s Future: Technology Meets the Marketplace,” 5, Presentation to the 58th Annual Convention Photo Marketing Association, International, Las Vegas, NV, 18 Feb. 1982, Box 25, Folder 14, Kodak Historical Collection #003, D.319. Legacy, Rare Books, Special Collections, and Preservation, River Campus Libraries, University of Rochester. In the same presentation, Fallon also argued, “If we were to use our Kodacolor HR film in a 35 mm format, the information recording capability of one frame of film would be the equivalent of what we might expect from an electronic camera with about 18.5 million sensor element” Fallon, “Photography’s Future: Technology Meets the Marketplace,” 7a. Even in touting Kodak’s breakthrough, award-winning 1.4 megapixel sensor, Wilbur J. Prezzano, Group Vice President and General Manager of Photographic Products, argued, “In spite of its great power and improvements over earlier video systems, this sensor is still 15 times below the information storage capacity of a single frame of 35 mm film” Prezzano, “The Future of Photography,” *British Journal of Photography* (19 Sept. 1986), 1086.

¹³⁷ These included lines of industrial (Megaplus) and professional (DCS) digital cameras in the 1980s and 1990s, the Photo CD introduced in 1992, as well as multiple consumer digital camera lines (e.g., DC and EasyShare) in 1990s and 2000s, respectively.

¹³⁸ Attesting to the degree of Kodak’s sophistication in electronics, George Gagliardi, an Arthur D. Little consultant, argued, “The development of the sensor by an American company took the industry by surprise. Most people had expected the advances to come from the Japanese, who have taken the lead in the industrial electronic camera market” Calvin Sims, “Electronic Imaging Gains,” *New York Times*, 5 June 1986, D2.

Technologies Division. The camera featured a 15-pound power supply and was priced between \$11,500 and \$18,000.¹³⁹ The 1.4-megapixel black-and-white camera became one of the first digital cameras capable of producing images that, when processed, could yield 4" × 6" prints comparable in sharpness to those from film photography.¹⁴⁰

Starting with the portable camera prototype developed by Kodak's Government Systems business unit for military use in 1987, over the next 15 years, Kodak designed and introduced dozens of digital cameras for professional photographers. In 1991, it launched the DCS, the first commercially available, single-lens reflex (SLR) digital camera. The six models of DCS series, priced between \$20,000 and \$25,000, sold 974 units between 1991 and 1994.¹⁴¹ These cameras paired the Nikon F3 film camera bodies with Kodak's electronics, incorporating the first megapixel color CCD, and were advertised as a means for professional photographers to "convert to a new digital system without switching cameras."¹⁴² In 2002, Kodak introduced the DCS Pro 14n, which featured a 14-megapixel resolution and \$4,995 price tag, well-positioned against Canon's forthcoming 12-megapixel camera priced at \$9,000.

When assessing the potential impact of digital cameras on the amateur film photography market in the 1980s, Kodak managers operated in an environment where 80% of film cameras in use were priced under \$50 and offered image quality comparable to digital cameras with resolutions exceeding 2 million pixels.¹⁴³ By comparison, the resolution of the electronic still video cameras—under 400,000 pixels—was much lower than that of images captured on photographic film though it was better than that of individual frames captured by a video camera or displayed from video home system (VHS) tapes. Market researchers identified the high price of electronic cameras, which were well-above the \$500 price of video cameras, as a further deterrent to consumer acceptance.¹⁴⁴

Kodak managers believed that hybrid products, which combined film and digital technologies, could offer consumers a superior value proposition compared with purely electronic cameras.¹⁴⁵ In keeping with this logic, in 1982, one year after Sony demonstrated the Mavica prototype, Kodak demonstrated a film-to-digital photo

¹³⁹ John Larish, "New Pricing Strategy for Megaplus," *Rochester Democrat & Chronicle*, 6 Nov. 1986, 10D.

¹⁴⁰ Bradley Paxton argued that the number of pixels in the camera's sensor was motivated, in part, by the goal of making a photographic quality 5" × 7" print. Paxton, *Pictures, Pop Bottles and Pills: Kodak Electronics Technology that Made a Better World but Didn't Save the Day*, 2nd ed. (Rochester, NY, 2020), 55–56. Gus Kawahi, the manager of Kodak's Videk subsidiary, described Megaplus resolution as 16 times higher than that of the low-resolution cameras marketed by Canon and Sony. "Videk Taking Orders for Megaplus," *Rochester Democrat & Chronicle*, 5 Nov. 1986, 8D.

¹⁴¹ Jim McGarvey, *The DCS Story* (June 2004), accessed 22 Aug. 2022, <http://eocamera.jemcgarvey.com/pdf/dcsstory.pdf>.

¹⁴² McGarvey, 6. In 1995, Kodak partnered with Canon to produce the EOS-DCS D-SLR line of professional digital cameras that were marketed by both Kodak and Canon.

¹⁴³ Douglass C. Harvey, "Challenges for the Photographic Industry in the 1980's," 18. Keynote Address to the National Association of Photographic Manufacturers, 5 Nov. 1981, Lago Mar, FL, Box 25, Folder 8, Kodak Historical Collection #003, D.319. Legacy, Rare Books, Special Collections, and Preservation, River Campus Libraries, University of Rochester.

¹⁴⁴ Clare Ansberry, "Makers of 'Still-Video' Cameras Refocus Marketing Efforts on Commercial Users," *Wall Street Journal*, 24 June 1987, 29. Video Home System (VHS) tapes were a dominant analog format for recording consumer video introduced by the Victor Company of Japan (JVC) in 1976.

¹⁴⁵ Harvey, "Challenges for the Photographic Industry in the 1980s," 23.

viewer prototype at Photokina, the world's largest photography trade show. The device scanned images from film, displayed them on a TV screen, and allowed users to zoom in on specific features, as well as make color corrections, enlargements, and cropping adjustments. These edited images could then be transmitted to photo processors (firms that developed film for the consumers) for printing.¹⁴⁶

For Kodak, the film-to-digital photo viewer prototype became the foundation for two hybrid products: the Photo CD, announced in 1990 and introduced in 1992, and the imaging kiosk, launched in the US in 1997.¹⁴⁷ The Photo CD merged digital and film technology, allowing consumers to receive not only developed film but also a CD containing high-resolution digital image files from their photo processor. These images could be displayed on a TV set using a specialized Photo CD viewer device.¹⁴⁸ Capable of storing 100 images at approximately 18 megapixels each, the Photo CD preserved the high resolution of film images.

In introducing the Photo CD, Kodak sought to make the lower-resolution offerings from competitors' digital cameras unacceptable to potential users. The resolution of images on the Photo CD was 16 times higher than that of the prevalent TV sets at the time and four times higher than the resolution of the nascent high-definition television (HDTV) format. A *USA TODAY* reporter described the quality of Photo CD images as "the Kodak images displayed on the TV are stunningly sharp and crisp—a marked improvement over the electronic photography systems developed by Sony, Polaroid and other firms."¹⁴⁹ Likewise, a *New York Times* technology columnist described how the differences in resolution also translated into superior print quality, with Photo CD prints that "look like a photograph, not like a bad, dot-filled reproduction."¹⁵⁰

To capitalize on the improving performance of personal computers, Kodak formed a Computer Camera Products group in June 1992. Rather than commercializing products independently, the group pursued a novel partnership model, where Kodak would act as an OEM, developing and manufacturing cameras for other companies. The group's inaugural product resulted from a partnership with Apple Computer. First launched in 1994, the Apple Quicktake 100 was a digital camera designed and manufactured by Kodak yet marketed by Apple. The camera's sensor was based on the one used in the DCS 200, the second-generation SLR camera developed by Kodak's

¹⁴⁶ Everett H. Ortner, "The Coming Electronic Revolution in Photography," *Popular Science* 226, no. 3 (Mar. 1985): 60–62, 105, 106.

¹⁴⁷ The kiosks, first rolled out in Australia starting in the fourth quarter of 1993, enabled customers to manipulate and print their images at the local photofinishing provider, becoming Kodak's only hybrid product that turned a profit. We are grateful to Ken Parulski for providing us with the kiosk development timeline.

¹⁴⁸ Inspired by Kodak's 1982 demonstration, at the 1984 Photokina, Fujifilm demonstrated its Photo-TV System. This device allowed consumers to view their photos on the TV screen by first using a photo processing service that would save their negatives on a 2-inch still video floppy disk. Fuji priced the TV-Photo System in Japan at about US \$200. Unlike the Photo CD announced by Kodak in 1990 which displayed high resolution images, Fuji's TV-Photo viewer displayed lower-resolution images compatible with the Still Video Floppy Disc standard originated by Sony. Peter West, "Electronic Still Cameras at Photokina," *British Journal of Photography* (23 Nov. 1984), 1258.

¹⁴⁹ John Hillkirk, "Picture This: Kodak Offers Photo CD Album," *USA TODAY*, 18 Sept. 1990, 2B.

¹⁵⁰ Andy Grundberg, "Kodak Announces Tantalizing Bits from Its World of New Technologies," *New York Times*, 23 Sept. 1990, 67.

professional division. Hailed by industry observers as a price/performance breakthrough, 80,000 Quicktake 100 cameras were sold in the first year—an eightfold increase in the number of digital cameras sold up to that point.¹⁵¹

Also in 1994, Kodak formed a Digital and Applied Imaging group, a new business unit, to focus Kodak's digital efforts:

Our traditional businesses will continue to furnish the majority of our earnings for a long time. However, fueled by digital technology, digital imaging is growing faster than conventional photography. To share in this growth, we must be successful in exploiting our own electronic technology in the marketplace. It is time to focus special attention on both traditional and digital growth opportunities.¹⁵²

In keeping with those goals, Kodak continued to develop digital cameras aimed at the mass market. Trade publications such as *Popular Science*, *PC Magazine*, *CNET*, and others recognized Kodak's consumer digital cameras as the best available. In 1999, the year when worldwide sales of digital cameras first surpassed the 1-million-unit mark, *Business Week* compared Kodak's DC240 digital camera with Fujifilm's MX-1700 and Sony's Cybershot DCS-F505: "They're all impressive examples of digital imaging technology, but the standout on pure picture quality is the Kodak."¹⁵³ In 2004 and 2005, Kodak held the leading market share in digital cameras in the US.¹⁵⁴

Despite these technological advancements, award-winning products, and market leadership, Kodak's digital photography business did not break even until 2003.¹⁵⁵ Initially, the lack of profitability stemmed from delays in consumer adoption of digital cameras. While Kodak developed the first digital camera prototype in 1975, digital camera sales did not surpass those of film cameras until 2002—more than a quarter-century later. The delay in demand realization and the scale of Kodak's investment made analysts question the wisdom of the company's commitment to digital photography. For instance, Ty Govatos, a Donaldson Lufkin Jenrette securities analyst, summarized his view of Kodak's investments in copiers and digital photography as follows:

Most analysts still refuse to believe that Kodak's 10-year panic in electronic photography, most of which is included in the Information sector, has been

¹⁵¹ Alexis Gerard, "A Conversation with Don Strickland—Part 2," *Future Image* 4, no. 8 (Jan.–Feb. 1997), 3.

¹⁵² *PR Newswire*, "Kodak Announces New Digital Imaging Organization," 28 Mar. 1994.

¹⁵³ Geoffrey Smith, "A Whole New Bag of Digital Tricks," *Business Week*, 22 Nov. 1999, 138.

¹⁵⁴ "Kodak seizes U.S. digital camera lead" *New York Times*, 3 Feb. 2005, accessed 10 Feb. 2022, <https://www.nytimes.com/2005/02/03/business/worldbusiness/kodak-seizes-us-digital-camera-lead.html>; "Kodak tops U.S. digital-camera market," *NBC News*, 9 Feb. 2006, accessed 10 Feb. 2022, <https://www.nbcnews.com/id/wbna11258928>.

¹⁵⁵ Eastman Kodak Company, 3rd Quarter Sales and Earnings Conference Call, 22 Oct. 2003, 4. Securities analysts expected Kodak's digital business to break even in 2002. For example, see Caroline Sabbagha and Sherry Kim, "Eastman Kodak: When Being the Best Might Not Be Enough," *Lehman Brothers* (7 Sept. 2000), 16. The anticipated timeline for achieving profitability was pushed out several times. Peter C. Ausnit and Matthew F. Kelly, "Eastman Kodak Company," *Deutsche Bank Securities Inc.* (3 Jan. 2003), 5.

costing the company \$200 to \$400 million annually in operating losses. That amounts to \$0.35 to \$0.75 per share in losses after taxes.¹⁵⁶

When demand for digital cameras materialized in the early 2000s, low barriers to entry and stiff price competition characterized the industry's competitive dynamics, thus further eroding any potential for high profitability.¹⁵⁷ In response to these challenges, Kodak pivoted to the inkjet printing business, expecting to capitalize on the printing of the growing number of digital images produced. The company aimed to leverage its electronic and chemical expertise as well as strong brand reputation to build a consumer inkjet printing franchise and profit from the high margins available in printer ink. This strategic shift built upon decades of investment in inkjet technology and aligned with the views of financial analysts regarding Kodak's potential avenues for success.¹⁵⁸ For instance, in initiating their coverage of the Eastman Kodak Company for Lehman Brothers, analysts Caroline Sabbagha and Sherry Kim wrote:

We think it is extremely important for Kodak to have full ownership of inkjet printer technology. We think that a good portion of the incremental output in digital photography is likely to be done at home. Therefore, we believe that Kodak needs to be able to fully benefit from the profitable consumables stream in the inkjet market, especially since ink cartridges are one of the few products that have margins that rival those of film.¹⁵⁹

To succeed in this pivot, Kodak named Antonio Perez, a former Hewlett-Packard executive, its CEO in 2005. Under his leadership, Kodak launched a line of consumer inkjet printers in 2007.

However, the introduction of Apple's iPhone in 2007, followed by the rise of smartphones with high-resolution cameras and large screens, had a twofold effect on the digital photography ecosystem: (1) it dramatically reduced the value proposition of standalone digital cameras, making them unnecessary for most consumers and (2) it also provided an alternative way to share the pictures, reducing the need for

¹⁵⁶ Ty Govatos, "Kodak—Company Report," Donaldson, Lufkin & Jenrette Securities Corporation (29 July 1992), 1–2. Mary J. Benner argues that securities analysts tend to be skeptical of incumbents' efforts to invest in disruptive technologies. For example, see Mary J. Benner, "Securities Analysts and Incumbent Response to Radical Technological Change: "Evidence from Digital Photography and Internet Telephony," *Organization Science* 21 (Jan.–Feb. 2010): 42–62 and Mary J. Benner, "A Non-Event Study in Two Industries," *Industrial and Corporate Change* 17 (July 2007): 109–154.

¹⁵⁷ The low barriers to entry in the digital camera industry stemmed from the availability of technology licensing for the key components of the camera and contract manufacturers capable of producing state-of-the-art cameras.

¹⁵⁸ Kodak acquired Mead Digital Systems in 1983. The division, renamed Diconix, introduced the first portable inkjet printer in 1984. Kodak sold the division to Scitex in 1993 and reacquired the company in 2004. Paxton, *Pictures, Pop Bottles and Pills*, 47–49, 96. Kodak also worked with Hewlett-Packard on developing a high-quality inkjet printer in 1995. Wendy Bounds and Joan E. Rigdon, "Kodak, Seeking Inroad in Digital Arena, Opens Up Proprietary Photo CD System," *Wall Street Journal*, 29 Mar. 1995, B9. Kodak also introduced an inkjet printer in 1999 in partnership with Lexmark, albeit with limited success. Bruce Upbin, "Kodak's Digital Moment," *Forbes* (21 Aug. 2000), 109.

¹⁵⁹ Sabbagha and Kim, "Eastman Kodak," 8.

printing images and undermining the appeal of inkjet printers.¹⁶⁰ The challenges of balancing the capital requirements for growing the struggling inkjet business with managing expenses from shutting down the legacy film business resulted in severe cash shortfalls, ultimately leading Kodak to seek bankruptcy protection in January 2012.

In summary, over four decades, Kodak's investments in digital photography yielded multiple technological breakthroughs and recognition for its technology leadership. In addition to technological innovations, Kodak explored several pathways to commercializing digital technology, introducing digital and hybrid film-digital products for existing and new industrial, professional, and consumer photography markets. Despite these pioneering and substantial efforts at digital transformation, Kodak faced significant challenges with respect to finding a viable business in light of the uncertain timing of market adoption and increasing competition.

Conclusion

The history of Kodak illuminates the process of corporate decline for an iconic, innovative, and customer-focused company, illustrating some of the challenges of sustaining long-term success. Kodak's decline cannot be solely attributed to fear of cannibalization or the rigidity of its business processes or routines. While these inertial factors were likely present in some decision-making processes, as is typical in many established enterprises, Kodak's failure followed sustained efforts over multiple decades to identify new, viable growth opportunities. These efforts sought to leverage its technological competencies and capitalize on the opportunities presented by emerging digital technologies.

Kodak's strategic initiatives included diversifying into plain paper copiers and pharmaceuticals and developing various digital photographic applications. In both the copier and digital photography markets, Kodak achieved technological leadership by introducing products that set the industry standard. For example, in the copier business, Kodak's Ektaprint copiers were the first to incorporate microprocessors. Despite launching over 15 years after Xerox's introduction of the 914, these copiers became the standard for copy quality. Operating with a fraction of Xerox's R&D budget, Kodak maintained technological leadership in niche areas such as color copiers. In pharmaceuticals, Kodak successfully revitalized Sterling's drug development pipeline. It formed an R&D alliance with Elf Sanofi to compete with larger firms, with the health division contributing a quarter of Kodak's revenues and earnings. In digital photography, Kodak introduced numerous innovations, including the first integral color sensor, the first-megapixel sensor, and the first digital SLR camera.

¹⁶⁰ Ron Adner, *Winning the Right Game* (Cambridge, MA, 2021). The delayed acceptance, followed by the rapid demise of the demand for digital cameras, mirrors the trajectory of fax machines. While the first patent for a fax machine was granted in 1843, as late as the 1970s, an affordable machine that could transmit a page in less than a minute remained out of reach. Following the rapid acceptance of fax machines in the 1980s, the mass market declined in the late 1990s as electronic forms of communication gained popularity. For a detailed history of the fax technology and its commercialization, see Jonathan Coopersmith, *Faxed: The Rise and Fall of the Fax Machine* (Baltimore, MD, 2015). We thank an anonymous reviewer for highlighting the similarities in the trajectories of digital cameras and fax machines.

Such technological leadership enabled Kodak to shape the trajectory of digital photography toward a focus on high-resolution images.

Despite demonstrating technological leadership and making substantial investments over multiple decades to renew itself, Kodak ultimately struggled to secure a viable path forward. Accordingly, the company's decline presents a significant puzzle in strategic management. How can an established enterprise, which recognizes the changes in its environment and spends several decades under different leaders exploring multiple avenues across diverse markets and technologies to sustain its competitive position, ultimately fail? The answer to this puzzle may lie in understanding the strategic context in which these renewal efforts were undertaken, as well as the complex challenges and constraints that such efforts inevitably face.

First, the potential of any new path explored by an established enterprise is often evaluated in comparison with its past success.¹⁶¹ When identifying new profitable growth opportunities, Kodak's managers weighed these opportunities against the company's long and outstanding performance in film photography. Kodak's success in this area made it difficult to justify sustained investment in businesses that did not yield comparable returns. Second, the pursuit of new growth opportunities is inherently fraught with uncertainty, particularly regarding the timing and realization of potential returns. This uncertainty can arise from new and existing competitors vying for the same opportunities and the rate at which new technologies evolve to meet market demands. Kodak's entry into both copiers and pharmaceuticals was accompanied by substantial shifts in the competitive landscape. In the copier market, Kodak's entry triggered an intense competitive response, which led Xerox to restructure itself into a lean, aggressive competitor that used its scale advantages to deny new entrants market share and, consequently, profitability. Similarly, in the pharmaceutical industry, Kodak faced substantial challenges, including the rapid pace of industry mergers following the Sterling acquisition and several setbacks in clinical trials for new drugs, which hindered the company's ability to generate favorable financial returns. In digital technology, the protracted delays in the improvement of the technology and the realization of the mainstream consumer demand made it difficult for Kodak to capitalize on its pioneering innovations.

Third, while an established enterprise may pursue new growth paths, such renewal efforts often impose significant short-term costs that attract intense scrutiny and pressure from the various stakeholders.¹⁶² In Kodak's case, the substantial financial commitments—amounting to hundreds of millions of dollars annually—for its ventures into copiers and digital photography resulted in underperformance. In addition, the \$5.1 billion acquisition of Sterling Drug, financed through considerable debt, elicited a strong negative reaction from both

¹⁶¹ For a discussion of how Xerox's experience with the 914 affected its evaluation of future markets, see Natalya Vinokurova and Rahul Kapoor, "Converting Inventions into Innovations in Large Firms: How Inventors at Xerox Navigated the Innovation Process to Commercialize Their Ideas," *Strategic Management Journal* (Dec. 2020), 2372–2399.

¹⁶² For an important analysis of the securities analyst response to Kodak's digital initiatives during the 1990s see Benner "Financial Market Reactions Following Technological Discontinuities" and "Securities Analysts and Incumbent Response to Radical Technological Change."

securities analysts and credit rating agencies, further intensifying the external pressures on the company.

Collectively, these features of the strategic context capture the problem statement for an established incumbent as it navigates shifting market and technology landscapes in an effort to sustain itself. In Kodak's case, the problem statement required the company to identify new businesses that approached the high profitability of the film business while contending with significant uncertainty regarding the timing of long-term business growth and incurring substantial short-term costs.

The history of Kodak provides valuable insights for today's established corporations in maturing markets that are seeking new growth opportunities. It highlights that, on the one hand, managerial foresight and commitments, coupled with scale and scope, are necessary for sustained growth. On the other hand, the success of the well-intended strategic initiatives can be constrained by unforeseen industry dynamics and interdependencies across businesses, as Kodak experienced. While Kodak's leaders recognized the need to build new businesses, leveraging the firm's scale and innovative capacity, shifts in markets and technologies introduced new uncertainties and interdependencies that were not present in Kodak's prior success, ultimately leading to underperformance in the face of high expectations.

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